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CACTUS AND SUCCULENT JOURNAL

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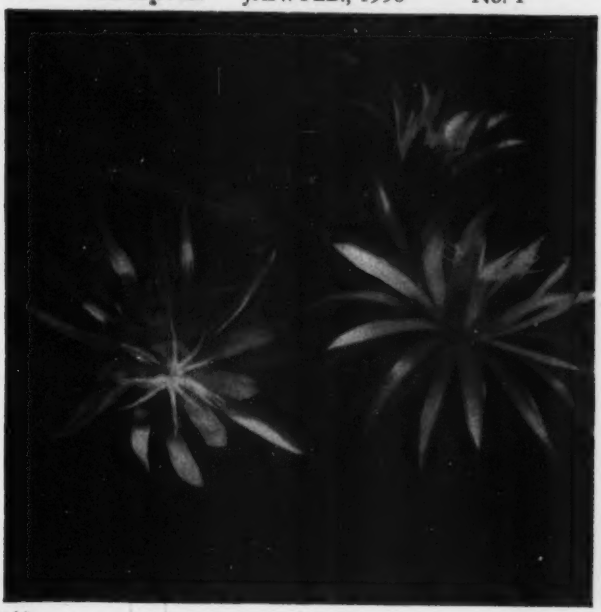

FIG. 1. The colorful *Cryptocereus anthonyanus* was discovered by T. MacDougall in 1946.

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COVER PICTURE

One of the most interesting of jungle cacti is the newly discovered *Cryptocereus anthonyanus.* While first found by T. MacDougall in the jungles of the state of Chiapas in Mexico, in January 1946, it could not be given a name until it flowered in June 1950. Then, it was named by the undersigned in honor of Dr. H. E. Anthony of Englewood, N. J. This picture is of the second flowering in June 1951. This plant is of the group of cacti which require both heat and moisture for their well-being, but differs from most of them in its climbing habit, using aerial roots to pull itself up into the trees. The deeply lobed stems are also unusual, looking like large, coarse fishbones. Its flowers are intensely fragrant and last but a single night. They are beautifully colored, the combination of maroon and cream-yellow making a striking contrast.

Mr. MacDougall has been responsible for the discovery of many new and interesting plants in southern Mexico, a number of which are growing in the living plant collections of The New York Botanical Garden.

E. J. ALEXANDER

This new genus was described in this JOURNAL Nov.-Dec. 1950, page 163. The color plate on the cover of this Jan. 1956 issue was loaned through the courtesy of the New York Botanical Garden Journal in which this plate appeared in the Jan. 1952 issue.

EDITOR'S NOTE

Your Editor is grateful for the loyal support expressed by the vast majority of the Society Members when they sent in their renewals. The next 23 years of the Journal is now assured and we are giving you a little color and extra reading matter in this first issue of Vol. 28 as a token of our appreciation.

JOURNAL INDEX

The Index for Vol. 27 will be found in the center section. This should be removed and placed with last year's issues.

ECHEVERIA "FLAMMEA"

Regarding *Echeveria* x *"flammea"*, there is no such name on record, the nearest being *E. flamifera,* which was a hybrid raised in France nearly 100 years ago. Our plant appears to be a hybrid of *E. metallica* H.

Cotyledon devensis was described and illustrated in the Botanical Magazine nearly 50 years ago, where it was stated to be a hybrid. However, this data is identical with the description of Rose's *E. holwayi* from Southern Mexico, which used to be grown at one time at Huntington Gardens, but is now lost. This would appear to be the species that grows along the railroad just north of Oaxaca. From Oaxaca came *E. acutifolia,* which was pictured in the Botanical Register, unfortunately from a very poor specimen. In my opinion all three are the same, and should be called *E. acutifolia.*

ERIC WALTHER

FIG. 2
Epiphyllum chrysocardium sp. nov. Portion of the flowering plant —approx. ⅓ natural size.

Epiphyllum chrysocardium – A New Species

By E. J. ALEXANDER

Evidently, it will be some time before the last word can be said of Mexican Epiphyllums. It was thought that all the different group types had been found, and now along comes T. MacDougall with an unusual new type from Chiapas. When "Mac" first brought the sterile branch into my office in May, 1951,* my first thought was that he had an odd fern or aroid, but close examination soon proved it to be a cactus in the Epiphyllum relationship, but genus uncertain.

In November, 1953, five buds were observed developing on the plant grown from the original cutting, but four of them yellowed and fell before they were more than half-grown. The fifth bud, however, continued to increase in

*See Cactus and Succulent Journal, Nov.-Dec., 1953, pp. 160-161.

FIG. 3
Epiphyllum chrysocardium sp. nov. Face view of flower—3/5 natural size.

size, and by Christmas it became very apparent that flowering was close at hand. Day-by-day watch was kept, and finally early in the morning of January 2, 1954 a telephone call was received that it had blossomed during the night and was still in good condition. "Furthermore" said the gardener who called, "it is a beauty". Gathering together photographic equipment, a quick rush was made to the greenhouse, where the gardener's opinion was soon seen to be correct—it was a beauty. It proved to be a pure white, somewhat cupped flower very similar in size and form to that of *Epiphyllum macropterum,* but the filaments instead of white, were a deep gold in color, tipped with slate-brown anthers, giving a startling effect against the white petals. There was and is no question as to the newness of the species, and it is accordingly presented as the golden-heart epiphyllum, *Epiphyllum chrysocardium.*

Epiphyllum chrysocardium Alexander, sp. nov. Planta epiphytica, phyllodia explanata, ad 30 cm. lata, lobata ad costam, lobis 13-15 cm. longis et 4 cm. latis, acuminatis arcuatis ad apicem; areolae parvae, nonnullis cum 2-3 setis. Flores 32 cm. longi; ovarium 2 cm. longum, valde tuberculatum, squamis 3-7 mm longis, 2-4 setis in axillibus; perianthii tubus 16 cm. longus, 1.25 cm. latus, squamis 8-12 mm. longis; perianthii segmenta 11-14 cm. longa, exteriora 8-10 mm. lata, sordide roseo-purpurei lanceolata acuta, interiora 15-25 mm. lata, alba, oblanceolata, abrupte mucronata, apice paulum erosa; stamina filamentis aureo-luteis 11 cm. longis, antheris 3 mm. longis atrobrunneis; stylus 25 cm. longus, 3.5 mm. diametro lacteus,

FIG. 4. The rain-forest of northern Chiapas, Mexico. This is the type of country in which the new Epiphyllum grows.

FIG. 5. *Epiphyllum chrysocardium* sp. nov. in natural habitat.

stigmatum lobi 13, 1.5-2 cm. longis, subulati; fructus ignotus.

Epiphyllum chrysocardium Alexander, n. sp. This new plant has flattened, thin phyllodia up to 30 cm. wide, and lobed to a slightly 2-edged midrib, the lobes 13-15 cm. long and 4 cm. wide, upcurved at the outer end into tapering tips. Areoles merely small notch-like pits at the base of the upper side of the lobe, sometimes bearing 2 or 3 bristles. Flowers 32 cm. long; ovary 2 cm long, strongly tuberculate, the tubercles tipped with pale green scales 3-7 mm. long, their axils felted and with 2-4 stiff bristles 2-4 mm. long; tube 16 cm. long, 1.25 cm. thick, pale green on the lower 7 cm., upper portion stained dull rose-purple, the scales on the tube 8-12 cm. long, green, the upper ones purplish stained; perianth spread about 20 cm., the segments 11-14 cm. long, their lower 1-2 cm. decurrent; outer segments linear-lanceolate, acute, spreading, 8-10 mm. broad, dull purplish rose, the next series purplish on midportion, the next brownish-rose margined, the inner segments pure white, broadly oblanceolate, abruptly mucronate, the apex shallowly erose; stamens with deep chrome-yellow filaments 11 cm. long, attached in a descending series from the top of the throat portion to halfway down the tube, the anthers slate-brown, 3 mm. long, the pollen cream colored; style 25 cm. long, creamy white, 3.5 mm. in diameter, stigma-lobes 13, 1.5-2 cm. long, subulate, cream colored; fruit unknown.

Type collected by T. MacDougall in the northern part of the state of Chiapas, Mexico, in tropical rain-forest of the region known as the Selva negra, between Tapalapa and Blanca Rosa near Santa Lucía and the Rio Napak on Feb. 9, 1951, and flowered in the conservatories at the New York Botanical Garden the night of Jan. 1-2, 1954. Specimen deposited in the Herbarium of the New York Botanical Garden.

Epiphyllum chrysocardium is very clearly close to *E. macropterum* in its relationsihp, but obviously widely differing in the width and lobing of the phyllodia, the color of the stamens, and the somewhat differently constructed flowers with strongly tuberculate ovary. The flowers have the odor of sour cream. This surprising discovery from a little-explored section of Chiapas arouses interesting conjecture as to just what else may await collectors in other out-of-the-way corners of Mexico.

NEWS FROM "SPINEY" RIDGE

By EDITH BESTARD

More blossoms on *Ariocarpus kotschoubeyanus* and *A. retusus,* and one red blossom and a circlet of buds on my beautiful Old Lady—*Mammillaria habniana.* This unexpected florescence, which didn't occur last year, bolsters my belief in a very cool, bright location for plants in winter.

Practically all my spiny cacti are in the south windows of an unheated room, and are watered sparingly, if at all. They appear supremely happy there, and I'm hoping to coax some flowers from the supposedly winter-blooming *Neoporteria nigriborrida,* which has never performed for me as yet.

A question which is asked almost as frequently as "Why doesn't my Christmas Cactus bloom?" is the one, "How can I get my Peanut Cactus to flower?" Since the blossoms of *Chamaecereus silvestrii* are among the prettiest of the cactus tribe, it seems worthwhile to try to produce some.

Following several years of failure with my own plant, I read somewhere that this cactus is one which positively must be kept dormant from late fall to early spring. Experiments with various positions have shown that mine does best when it winters in the west window of an unheated room. Of course, the temperature never falls much below 40, but neither does it go very high. The stems of the Peanut Cactus should shrivel and turn reddish-purple in winter—they'll soon plump up and become bright green in spring time, and delight you with those lovely, fiery red blossoms.

Did you know that the truly rare cacti, which all collectors yearn to possess, are like many old persons? You can't tear them out of their life-time environment with happy results. For instance, if you live in a low, humid location, you can't succeed with cacti that grow near the eternal snows of the high Andes, nor can you succeed with specimens from the burning desert sands if your location is cold and wet.

Two methods that increase one's chances of keeping alive these unhappy "foreigners," are grafting, or raising them from seed. Many of us haven't mastered the first method, but nearly all of us can grow seedlings. These seem to develop, as they grow, an adaptability to unusual (for them) environments, and if we strive as best we can to imitate the growing conditions of their native lands, we can enjoy good success.

Of course, the trick is to find seeds of the real rarities. I expect a new catalog soon from my German source, and will report to you on the offerings.

A question came to me recently from an extensive collector of cacti, Mr. Edwin F. Wiegand, 1645 Kendall Drive, San Bernardino, Calif., and since I don't know the answer, I'll pass it on to you. Are there any species of *Neobesseya* growing in western Arkansas? Mr. Wiegand has had reports from reliable sources that there are, so if any of our Arkansas readers, or anyone else, can answer this question, communicate with me or with Mr. Wiegand. He has also heard that *Neobesseya* has been found in Idaho. What about that, Mrs. Vaninetti (a former resident), Mr. Posivio, Mrs. Kibbey, or others who may know?

I would be pleased to have reports on the success had by those who ordered *Toumeya papyracantha* through me last year. Mine appears healthy, though it has not made much growth. Another rare cactus—perhaps the rarest—is *Navajoa peeblesiana.* I have had an offer of this from one source at $10.00 per plant, in case any of you collectors are "well heeled". I confess that, as much as I yearn for one, it will remain on my want list for the present.

* * *

The above is reprinted from a monthly paper "Ozark Gardens" ($1 yr.) It is edited by Cactus Society Member Edith Bestard, 41 Kingshighway, Eureka Springs, Ark. Mrs. Bestard would like to obtain seeds of *Utahia sileri, Navajo peeblesiana,* and *Copiapoa cinerea.*

FLOWERING DATES OF CACTI AND OTHER SUCCULENTS

Your request for bloom-dates in the current bulletin interests me, as I have kept a rough graph on my own plants for several years. I am enclosing a copy of my 1954 chart, hoping that it may be of some interest; however, my collection is so young (1947) and since then so ill-advised by me that it may only confuse. After copying it off for you I was surprised to note the range and inconsistency of bloom of members of the same family. I am the rankest of amateurs, trying to grow plants that perhaps should never have seen New Jersey. Certainly not my ancient greenhouse with three visible leaks . . . and ten below predicted for tonight. This may well be the last word I will say about succulents . . . this batch, anyhow.

Sincerely yours,
MARJORIE WIHTOL
Middletown, New Jersey

Feb. 2

Acrodon bellidiflorus	Sept.-Oct.
Bergeranthus multiceps	Febr.-Oct.
Drosanthemum speciosum	May-June
Lampranthus falciformis	July-Aug.
Mesembryanthemum—	
unidentified	Jan.-Dec.
Oscularia deltoides	July
Stomatium fulleri	Apr.-June, July
Trichodiadema intonsum	May-Sept.
Ceropegia caffrorum	Jan.-June-Nov.
debilis	Aug.-Dec.
sandersonii	Oct.-Nov.
woodii	May-Nov.
Duvalia—unidentified	June-Aug.
Hoodia—unidentified	Aug.-Sept.
Huernia schneideriana	Apr.-Dec.
primulina	Sept.-Nov.
Piaranthus pillansii	Sept.-Oct.
Stapelia gigantea	Aug.-Sept.
hirsuta	July-Nov.
variegata	Sept.-Nov.
Stapelianthus decaryi	Sept.-Oct.
Astrophytum asterias	Sept.-Oct.
myriostigma	June-Oct.
Echinocereus rigidissimus	April
Epiphyllum oxypetalum	April-Oct.
(miscellaneous)	Febr.-May
Mammillaria (Unidentified)	Mar.-April
Rhipsalis micrantha	Mar.-April
Rhipsalis cassytha	Mar.-April
houlletiana	Sept.-Dec.
Zygocactus truncatus	Nov.-Dec.
x Schlumbergera	Oct.-Nov.
Cyanotis somaliensis	Jan.-Oct.
Tradescantia navicularis	May-July
Kleinia articulata	Aug.-Oct.
fulgens	January
gomphophylla	Oct.-Dec.
mandraliscae	July-Nov.
pendula	April-July
radicans	Oct.-Dec.
repens	May-July
Senecio stapeliaeformis	Jan.-May
Adromischus cristatus	Feb.-Mar.-June-Nov.
Crassula cooperi	January
corymbulosa	June-Dec.
cultrata	Aug.-Dec.
elata, var. rosea	Febr.-July
lactea	January
lycopodioides	Jan.-Febr.
sarmentosa	Sept.-Dec.
perforata	Jan.-Dec.
rupestris	Jan.-Febr.
schmidtii	July-Dec.
spathulata	June-Dec.
tetragona	July-Jan.
reversisetosa	July-Nov.
teres	Dec.-April
trachysantha	July-Jan.
Echeveria coccinea	Oct.-Dec.
setosa (x "Doris Taylor")	Mar.-June
gibbiflora hybrid	Jan.-April
x hoffmanni ?	May-Aug.
gigantea ?	Sept.-Dec.
leucotricha	Jan.-Dec.
multicaulis	Aug.-Sept.
nodulosa	May-Aug.
pulvinata	Oct.-Mar.
pubescens, var. recurvata	Jan.-Febr.
x "soledad"	Dec.-June
Graptopetalum paraguayense	Nov.-Apr.
Bryophyllum daigremontianum	Nov.-Dec.
Kalanchoe scandens	Nov.-Dec.
fedtschenkoi	Nov.-April
laciniata	Jan.-April
lugardo ?	Nov.-June
marmorata	Nov.-Febr.
tomentosa	December
velutina	Nov.-Febr.
blossfeldiana	Dec.-Aug.
Orostachys spinosus	Sept.-Nov.
Pachyphytum hookeri	Nov.-Apr.-July-Aug.
Pachyveria	Nov.-Dec.
Rochea falcata	July-Sept.
(unidentified)	July-Sept.
Sedum adolphii	Dec.-Mar.
griseum	Oct.-Jan.
guatemalense	Febr.-Aug.
Sedum stahlii	April-June
treleasei	December
Euphorbia gorgonis	Sept.-Oct.
heptagona	Apr.-May
mammillaris	Jan.-July
meloformis	Sept.-Nov.
splendens	Jan.-Dec.
Synadenium grantii	Oct.-Nov.
Apicra pentagona	Dec.-Jan.
Gasteria brevifolia	Mar.-June
caespitosa	Jan.-Apr.-Aug.-Oct.
neliana	Oct.-June
pulchra	Febr.-April
verrucosa	Jan.-Mar.
Haworthia chalwinii	July-Dec.
cuspidata	June-Aug.
cymbiformis	Jan.-Mar.
fasciata	Febr.-May
papillosa	April-July
Anacampseros poellnitziana	April-Jan.

Dr. Wm. S. Chapin of Michigan would like to see more news of research on cacti such as physiology—factors affecting growth or supression of spines, flowers, and offshoots, etc.

Dr. H. C. Lawson, 595 Meadow Grove Place, Pasadena, California, desires information on the chemical analysis of *Selenicereus grandiflorus*. This is the plant that is well known for its use in heart remedies.

RECOMMENDED BOOKS FOR BEGINNERS

GLOSSARY OF SUCCULENT PLANT TERMS—
Marshall and Woods—$3.65
AMATEUR BULLETIN—Scott E. Haselton—$1.50

ABBEY GARDEN PRESS
132 W. Union Street **Pasadena, California**

Cereusly Speaking

John E. C. Rodgers
1229 E. 8 St., Lorain, Ohio

As the year draws to a close and winter sets in here in Ohio I've a few observations to make for the 1955 spring, summer, and fall. About five years ago I found that certain faithful bloomers were not doing so good a job as they had in the past. The roots were free of nematodes and looked normal. The growth, although slowed up, showed no toxic effects that I could find. Spine growth was good but not colorful and the stem growth was fine but not lush as formerly. My notes showed that my soils had all the regular ingredients with the exception of boron and lime which I had left out as not needed since most of the soils were supposed to have calcium in them in this locality and boron in combination was found in the western soils but it was not needed by the plants, just a happenstance.

In my reading I found several references to the use of calcium and boron to supplement the other nine elements known to the plant "nutritionist". These two came the nearest to satisfying my equation. I had added borax to my southwestern soils at least twelve years ago and found spine growth was heavier and better colored than before. The plants that were greenhouse grown had flowered better than collected ones. I added boron by watering with boracic acid waterings. Calcium was added as crushed limestone, air slaked lime, old plaster (gravel size) and dolomitic limestone dust.

The response in the last three years shows that the "Old Man" (*Cephalocereus senilis*) is not the only one that needed lime. The Epiphytes such as Epiphyllums (Orchid Cactus), Rhipsalis, etc. also benefited from small amounts. The Heliocereus, Nyctocereus, Pilocereus, etc., also responded to varying amounts. Some European gardeners say that lime is needed to help the plants absorb other minerals. If this is so, which I think it is, then calcium as well as boron are the very cornerstones of plant nutrition. An example of this is an *Epiphyllum guatamalense* with stems up to five feet long. It had grown well and bloomed now and then, usually in late September. Three years ago I gave it a tablespoon of slaked lime and watered it in. The soil at this time was at least three years old. The pot was an 8-inch across and about the same depth. Applications of rotted manure as well as Vigoro merely increased the lushness of the foliage with one to three blooms a year. The lime did the trick—last year it set 10 buds of which four opened in early September and the rest blasted. This year it bloomed profusely in July, August, and early September. The limb was heavier, the petals longer and the flowers stayed open well over the usual 12 hours. Cold weather stopped the last buds or it would have bloomed late in October.

I have talked to growers in plant houses in public parks and they all agree that lime is a must for good plant growth from trace to liberal proportions. If the soil is new not over a small amount may be needed, but if the soil is old and well leached, larger amounts are necessary. Some advised steamed bone meal for Epiphyllums as well as other cacti (I have been advised by some western growers that these directions are being changed because of the alkaline nature of our water supply in the East). They claim it builds up enough alkaline reaction to take care of the bone meal part in the soil formula.

I do not believe soils are depleted even when the plant has been in the same soil for three to even five years. I do believe, however, that the roots may have filled the pot and the soil is no longer in contact with the root hairs. I have in such a case taken the plant out, shortened the roots, aerated the soil and put it back in the pot. The plant resumed growth and looked fine. I learned this from several that dropped on the floor by mistake and being a lazy type I decided to wait and do it later. The plant was in the same soil, the same size pot, the only difference was the soil had been "reshuffled". Most of the succulents have small root systems and grow wedged into places that contain not much more soil than I give them (I read this some place a long time ago. It helps).

I use Vigoro and lime, Vigoro and borax, Vigoro and bone meal, and Vigoro watered in with boracic acid. Each combination is tested and retested and the results kept for at least two to five years. Plants do better in old soil if trace minerals are used. New soils need less but I always mix minerals in my soil mixtures.

Selenicereus breaks easily and is hard to repot even under favorable conditions but I do not believe in repotting. When they show toxic conditions I water heavily until water runs through for some time. After this I let them dry out, rewater, top-dress with Vigoro and sand (decayed manure and sand if I can get it) and watch. New growth is of the same pristine size and color and blooms start to increase. How long have my Selenicereus been getting this treatment? Well, I should say for at least twelve years. The new growth is such that I trimmed my plants and started new ones in case the old plants died.

We need more research into the use of calcium in the soils for other than South Western varieties and those of semi-arid conditions. It is a vital element in the cell building operation or even "releaser" of minerals from complicated compounds in the soil or built up by watering, fertilizing, etc.

I could picture the gravel beds of equatorial Africa with their variety of succulents when my *Lithops* bloomed this fall. I reveled in the perfume of *L. lerchеana* with its delicate almond perfume from the bloom that opened daily for three weeks. No friendly bees visited it so it languished alone, a feast of beauty for my eyes. I have been told that my nose could add perfume of exotic proportions to a skunk—be that as it may, I do sniff everything that blooms whether it is supposed to be scentless or not.

The life cycle of the stem section of *Ariocarpus trigonus* from a plant that fell apart in Eugene Ziegler's greenhouse circa 1932 came to close in July 1955. It started to turn brownish yellow at the tip two years ago but the end came in July while I was at the Convention. Two bulbous roots from the base and a core of fibrous material from bottom to tip of stem showed that it acted much the same as a plant would have done. These cacti of ours are tenacious of life the same as the rest of us critters.

The hardy *Opuntia compressa* evidently does not expect to be frozen out by the cold weather. The roots have anchored themselves under stones and the spines stick out in all directions so that the fruit of this year's flowers are protected from maurauders. I do not expect too much snow so they will be there next spring, shrivelled but ready for a new generation. Field mice usually devour the fruit while covered with

snow. Two seedlings are battling it out with the ants that added a new chopped grass thatch over their nest. The seedlings merely sent out two long shoots which can't be covered up. The seeds evidently were carried up by the ants last year.

Next time I plan to write about my trips to the New York and Montreal Botanical Gardens. The new ideas one gets from seeing the experts work are well worth the time and expense involved.

JOHN E. C. RODGERS
1229 8th Street
Lorain, Ohio

Four Hundred Cacti in One Soil

My husband and I read Mr. Proctor's article in the November-December Journal on the use of a single soil mix with great interest and also a feeling of satisfaction that our own views, after experimentation, have been borne out by someone's else experience.

None of our cacti are in individual containers (except the epiphytes); all are planted in beds. And our mix is the same for all, though there is a slight variation from Mr. Proctor's. It is impossible to use the surface soil in our area—it is a black glutinous mass that is commonly called "gumbo", and which is rejected by growers of all kinds of plants in this area. About 35 miles to the south, however, the soil is quite sandy (farmers grow peanuts and watermelons there). We bring this in, mix it in equal parts with Colorado River sand and leaf mold, adding a little additional coarse crushed gravel. And we apparently break more rules in the leaf mold we use. We gather and screen the mold from thickets and woodland in the area. For some time we used cedar leaf mold and were told in rather horrified tones by nurserymen and others that it was no good—much too oily. Our plants have flourished with it. Because of easier access, however, we switched to live-oak leaf mold, and were met with the same disagreement; this time, however, on the basis that it is too acid. And this was supposed to be particularly bad where cacti are concerned, since they want an alkaline soil. (NOTE: we add no lime to our mix). And they have flourished just as well. In one bed we deviated by using cotton hull compost (decayed cotton hulls, sold in this area). This was in the nature of an experiment and our plants love it.

Our not adding alkalinity to the soil is no accident, nor mere neglect. Since rain is very rare in these parts, practically any water which the plants get is faucet water. Since the source of our water is the Edwards Limestone, the water is not only hard, but real lime water. The soil below the gumbo (which we remove) is a limestone formation, and capillary action adds still more lime for the plants. As a result, the plants get sufficient lime in this way without any having to be added directly to our mix.

There are slight variations in our soil mix for the other succulents, principally in added richness. Here, for the Stapeliads, as an illustration, there is both a higher percentage of leaf mold and some added steer manure. Conversely, for the Mesembs, the soil is less rich. But basically, these differences are primarily of proportions only. Approximately half our other succulents are potted; the other half are in the open ground.

We tend to under-water everything, and while growth is not as rapid as if we gave the plants more, they are healthy, lusty plants, which flower exceptionally well. Whether we have just been phenomenally and accidentally lucky, or whether our premise is correct, we don't want to state. But experiments over a period of time make us believe it is not all luck. We have succeeded in flowering some plants that are supposed to be very reluctant to flower in cultivation. For instance, our *Kalanchoe marmorata* bloomed prodigiously and long.

We further have concluded that one of the principal things plants like is root room. It is for this reason that we have put them into beds as much as possible. The mixed beds include Euphorbias, Aloes, Aeoniums, Crassulas, Portulacarias, and others which flourish side by side.

Even though winters here are not to be compared with winters in the north, we nevertheless have bad weather. For instance, by mid-November this year we had temperatures of 26°, as well as some snow-fall. We have found that cold is not the principal enemy. It is wind-burn, frost, and rain. Since most of our cacti are native south-west plants, they are pretty well able to take care of themselves, though our Cerei and other specimens not accustomed to temperatures as low as 15° are offered some protection. We listen regularly to the weather forecasts, and act accordingly. If wind or frost is predicted, we cover the beds with burlap blankets (made of old burlap bags, opened, and then sewn together). These blankets offer protection against our light rains and we haven't lost any cacti in the last three years.

Our other succulents fare a little more kindly. Our bed is raised—instead of digging down, we built up. The bed stands two feet above the ground level. For the summer, it is open. For the winter we have built a collapsible frame made in five sections (four sides and roof). The frame is covered with cello-glass, and has two glass windows on hinges which are left open most of the time for ventilation. In the spring, the frame comes apart, is stored, and our bed is open again. We have wired the frame for electricity, and have two electric bulbs inside, so that when the weather is going to be really bad, we not only close it up, but turn on the electricity, and this adds enough additional heat to be helpful. We prefer the cello-glass to glass because it avoids the possibility of sunburn. For the winter, our potted plants are placed in another frame, constructed similarly, but completely open in front. For bad weather, a tarpaulin is dropped and secured. This frame is also equipped with an electric light bulb which raises the temperature eight or ten degrees. This system we have found completely satisfactory—no plants lost, plants healthy and blooming.

One thing we have concluded: there is no such thing as a general rule in cultivating cacti and the other succulents. Available soil varies; water varies; climate varies (here I mean not only heat and cold, but humidity, aridity, wind, etc.). All these factors have to be taken into account, so that what applies in one area, must be discounted in another. Even sun intensity is important, for plants which apparently take hot and more or less direct sun in their native habitat, in the majority of cases cannot take our direct Texas sun. Consequently, even though some plants are indicated as taking "full sun", that is not so with us—everything here must have and gets dappled sunlight.

On the whole, we think we've licked fairly well the cultivation problems of our approximately 500 plants—about 325 species—and just keep our fingers crossed against one horrible contingency—that we won't experience another winter with a week of sustained below-zero weather. It HAS happened here!

MR. AND MRS. JOSEPH KRES
San Antonio, Texas

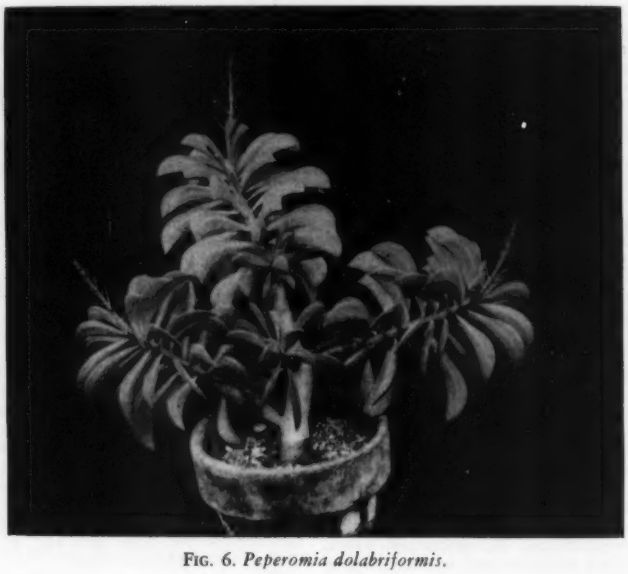

FIG. 6. *Peperomia dolabriformis.*

PEPEROMIA DOLABRIFORMIS

A unique and interesting succulent from Peru

In 1948 while travelling in northern Peru, I rediscovered this odd plant. It grew in the canyon above the little village of Mocupe on a bank partially shaded by small trees. With it grew a very pretty *Jatropha* about a foot in height and bearing bright pink flowers. Another plant was a bulb related to *Stenomesson* but bearing a single, large leaf, like *Eucharis* and a scape of red and green flowers with very long exserted stamens.

In the wild, this *Peperomia* grew eight to ten inches tall with several thick leaves near the top but not much branched. The leaves have an odd scimitar shape, the upper edge bearing a pale green "window" analogous to that in the tips of the South African *Fenestraria* or Baby Toes. The succulent stems are about five-eighths of an inch in diameter. As in all Peperomias the raceme of flowers is not bright or particularly interesting.

In cultivation the plant is quite attractive, branches well and is easy to manage, presenting no cultural problems, simply needing a light location, a well drained soil and moderate amounts of water.

Several of the Peruvian Peperomias have these curious windowed leaves but the others I know are small plants generally growing in the crevices of rocks. I brought another one home but after flowering, which it does exuberantly in late fall, it goes to pieces and must be re-propagated. *Peperomia dolabriformis* is a good long lived plant. Since it was described about 100 years ago by Humbolt, Bonpland and Knuth, quite likely from Humboldt's collecting trip of 1799 to 1804, it probably is fairly wide spread though I saw it only at this one locality.

HARRY JOHNSON

GIBBAEUM DISPAR

This lovely *Mesembryanthemum* from Ladismith Division in South Africa is one of the prettiest of the genus. The thick, blunt leaves are softly pubescent, velvety to the touch and white in color though some forms are pale green. The blossoms are soft pink in color and generally appear in late December and January. The plants form small clusters from an inch, to six inches or more in old plants, in diameter.

The culture of this and other species of *Gibbaeum* is fairly simple. They prefer a quite sandy soil or even just sand with a little leaf-mold added. Watering should be done most carefully. Since they grow where rainfall is scant, not enough to support trees or even many bushes, it is evident they do not want regular watering. It is always safest to make sure the pot in which they are growing is dry before watering again. Do not just look at the surface but get a pencil or plant tag and dig down an inch and see. Too many waterings produce unnatural growth and the beauty of these little plants is their compactness. They generally produce, on each growth, just a pair or so of leaves each year. Their growth should be completely finished in May and watering should be tapered

FIG. 7. *Gibbaeum dispar.*

off until in late June they are perfectly dry. From the middle of June until September I keep them dry so they may have the full summer rest. The only watering done during the summer is very lightly and only if they show signs of shriveling.

At all times the plants should be in a light position preferably in a sunny window or if put outdoors protected from the rain. They will stand three or four degrees of frost but don't tempt providence!

The latest revisions of the genus recognize some sixteen species. In it have been merged such old friends as *Rimaria, Argeta* and *Mentocalyx*. Most of the species I have had at previous times and all were attractive and well worth a place in good collections.

HARRY JOHNSON

* * *

OFFICERS AND BOARD MEMBERS ELECTED FOR 1956

President—Dr. Lyman Benson
Vice-President—Don B. Skinner
Secretary—Mary Glade
Treasurer—Ethel Rush
Members of the Board:
Dr. Elzada U. Clover
Jack Whitehead
Harry Johnson Jr.

PRESIDENT'S MESSAGE

For the last eleven years Ethel Rush has served the Cactus and Succulent Society of America as Secretary. Her devotion to the Society has set a pattern which all of us may hope only to imitate. She has been not only efficient and accurate in recording the business of the Society but also she has carried on a volume of correspondence for which we are indebted deeply.

Homer G. Rush has served the Society energetically and well during his two terms as President and during earlier years as a member of the Executive Board and as chairman of the Research Board. He has revived activities of necessity discontinued during World War II, and he leaves at the end of his term an active and well-organized group. His energy, care, and thoughtfulness in organizing the 1955 Convention were apparent to all who had a peek behind the scenes.

The Rushes have served as an outstanding team, and the Executive Board wishes to express its appreciation to them for both their hard work in conducting Society business and their hospitality. It is a satisfaction to know that they will remain active on the Board and in new posts in our organization.

An excellent group of members has been elected to the Executive Board and to the positions of Vice-President, Secretary, and Treasurer. With this kind of support, a good year in 1956 is to be expected. Suggestions for the conduct and development of the Society will be appreciated, and each will be given consideration in the light of accumulated experience of the organization. In particular, it is hoped that members and affiliated societies at a distance may be brought into close relationship with the parent Society, despite the inherent difficulty arising from physical separation.

LYMAN BENSON

NEWS FROM THE RESEARCH BOARD

The Research Board, after two years of very little activity, is again getting into the swing of the work and is now ready to help the members with their problems of identification, nomenclature and horticulture.

If you have plants that you would like to have identified either send them or a good clear photograph with the information about where you obtained them or, if collected plants, where they were collected, and the Research Board will make every effort to identify them for you. If you send plants and want them back, be sure to include sufficient postage for their return.

The Research Board has just received a donation of several hundred color slides which will soon be arranged and ready for use by the Affiliates; notice of their availability will appear in an early Journal.

We are anxious to receive collected plants from anywhere in the world, for preparation and addition to the Society's Herbarium. When sending plants be sure to give the point of collection as accurately as possible, the altitude, the time of year, and whenever possible, a good photograph of the plant before collection. We are also always hunting for and compiling all the information available on succulent plants from all parts of the world so that your questions can be answered correctly.

Always remember, your Research Board was formed and is operating only for the purpose of helping you to learn more about your plants. Address all communications to the Research Board, The Cactus and Succulent Society of America Inc., 820 W. 115th St., Los Angeles 44, Calif.

Homer G. Rush, *Chairman*
Harry Johnson Sr.
Dr. Robert T. Craig
Scott Haselton

A New Cactus Pest in England

By C. E. L. GILBERT

From the Cactus and Succulent Journal
of Great Britain

A further pest which attacks our plants has been added to our worries. This newcomer eelworm has been with us for some time, but has only recently been discovered in association with cacti. It is far more troublesome and serious than our commonly known enemies, viz., mealy and root bugs, scale, rust, etc. It was first noticed on a quantity of imported plants from the Continent and was drawn to my attention by Mr. R. C. Dale of the Ministry of Agriculture and Fisheries. There are many parasitic eelworms known, some of which attack the foliage of plants and others attack the roots. Symptoms of root eelworm damage in many plants is not obvious and is easily overlooked when studying affected plants. To complicate matters there are two forms of root eelworm found to attack cacti and the symptoms they present on affected roots are entirely different from each other.

The two forms found are :—

1. Root-Knot Eelworm (Meloidogyne sp.). This eelworm enters the roots near a growing point and takes up a position under the outer layer of root and begins to feed on the interior tissues. The stimulation resulting from the presence of eelworms causes the roots to become swollen and produce the typical galls varying in size from pinhead to pea size or larger. The galls are smooth and shiny when first formed, but later the tissue breaks down and the surface may be rough and pitted giving an appearance not unlike club-root on cabbage plants. The range of hosts is wide and includes most of the glasshouse crops.

2. Cactus Root Eelworm (Heterodera cactii). This is a cyst forming species and is related to potato root and beet eelworms. It does not cause definite galls on the roots though some slight swelling may occur. The cysts are smaller than those of potato root eelworm, and a hand lens is essential to distinguish them from sand grains in the soil. The cysts are white when first formed in June to July, but from September onwards vary in colour from yellow to pale orange or dark brown. In the later stages the dark coloured cysts are extremely difficult to spot. They are spherical in shape with a dull sheen and are barely half the size of a small pinhead. This species is likely to be specific to cacti and succulents, but could perhaps adapt itself to survive on other plants.

As the pests feed on the root tissue, the plants are deprived of nutriment and only restricted growth can result. As the attack develops on a given plant, the number of eelworms rapidly increase from year to year, the roots of the plant become increasingly affected and may ultimately lead to death of the plant, in any case, an unthrifty plant is likely to attract other pests. The eelworm hatch will roughly parallel the period when the plant breaks dormancy, i.e., February to April, according to the temperature, etc. In due course, the eelworms emerge from the cyst and their cycle of life starts over again. It will be seen that in a very short space of time the plant, having no roots to sustain it, will be forced to live upon itself with disastrous consequences. Should you have a plant which, for no apparent reason, has ceased to grow, unpot it and closely examine the roots with a strong magnifying glass, when cysts or knots may be seen.

When Mr. Dale visited my nursery in connection with this matter, he suggested the answer to the problem may be to remove all the affected roots before dipping the base of the plants in a strong insecticide. As this would have been a colossal task, and Mr. Dale has emphasized the deadly nature of some of the materials he sugegsted I might try, I sought some other method of control which would not be a potential danger to me as well as to the pests I wanted to eradicate.

I was acquainted with the late Mr. Ramsbottom's treatment with Narcissi bulbs and started to experiment with hot water treatment of the affected plants at varying temperatures and durations, ranging from 120—140°F. and from five to 30 minutes. At 140° scalding of the plants took place. Eventually, after much trial and error, I have had reasonable success at 10 minutes at 120—125° maximum, at 125° very slight scorching took place.

Hot water treatment is used as a control for various forms of eelworm in different horticultural crops of greater economic importance where the thermal death point for the particular eelworms have been studied in detail and precise temperature treatments are recommended.

The Ministry of Agriculture are showing some interest in my work, and independent preliminary tests are in progress at the Plant Pathology Laboratory. Harpenden, to ascertain whether the range of temperature and duration of treatment gives a 100% control. I am not yet aware of the result of these trials, but I am confident they will be satisfactory. I, myself, am satisfied by the results obtained that eradication of the pest has taken place and, in all probability, all harmful soil pests, bacteria and micro-organisms are simultaneously destroyed as the rate of new, clean growth and stimulation of the plant is remarkable.

Treated plants must be kept in the shade for a lengthy period until new growth has been observed. The pest is not migratory from pot to pot and is only spread by direct soil contact, i.e., plunged or bedded out plants. Soil sterilisation is essential in the growing methods to prevent this eelworm, but this will prove of no avail if affected plants are introduced into clean soil; hence on any suspicion of their existence, plants should be first heat treated.

I have made careful examination of plants from all parts of the country, in fact, of the world, and it must not be thought that the source of the trouble is purely continental. This pest, in its many forms, is responsible for damage to the extent of many thousands of pounds annually and also exist in cacti collections. In common with many plant troubles, cacti eelworm is not new, it has been with us a long time on "difficult" plants which refuse to grow, etc. Now that one cause of difficulty has been isolated and eelworms found to be the cause, a great step forward in improving the health of cacti and the value of collections should result when precise methods of control are achieved.

The method which I used was as follows :—I obtained a domestic washing boiling pan which accomodated a metal sieve to which I attached wire handles permitting the sieve to be suspended slightly above the bottom of the pan. The boiler was filled with water and placed on the Ideal stove, careful watch being kept on the temperature with a thermometer. When the desired temperature was reached, i.e., maximum 125° (this allows for the loss of heat on immersion of the plants), the plants either potted or loose are placed in the sieve and carefully lowered

into the hot water, still keeping a check that the thermometer is constant within the 5° (120—125°) for the prescribed 10 minutes. The method could be facilitated by placing the boiler on a gas cooker.

In the case of small plants, I have completely submerged them with no adverse effect. Larger plants, the complete root or pot, with a portion of the stem, is immersed in the water. With the larger pots it is necessary to extend the time by 15—20 minutes in all. On removal the plants are allowed to cool off and placed in the shade as already advised. As this is an innovation in the treatment of our plants, it is advasable to use caution during the whole of this operation.

1. The principle in all H.W.T. equipment is to have as large volume of water to small volume of plants as possible to keep temperature constant as possible.
2. Where tanks are heated from one surface only, i.e., bottom, agitation of the water is desirable to avoid temperature gradient between top and bottom of tank.
3. Circular tanks are preferable to any other shape for more even heat distribution.
4. Loose plants, free of soil, are exposed to the full factors of the treatment. Plants in pots are difficult as actual temperature of root affected by (a) loss of heat by absorption in actual pot, which will vary with size and thickness of pot, (b) volume of soil in pot which will absorb heat relatively slowly in hot water and will vary with physical properties of soil, i.e., air space, organic matter content, etc.

Practical research will be required on these points, particularly to determine variation of duration of treatment required to "cook roots for a given time at a given heat, it cannot be done by guesswork. It must be pointed out that the plants so far treated have only been cacti, and tests are being carried out in respect of other succulent plants.

It will be interesting to know if any other members have knowledge of this matter in relation to cacti. A study of the literature suggests that no research has been undertaken in relation to eelworm on cacti and succulent plants.

I particularly wish to draw this very serious problem to the attention of the forthcoming I.O.S. Congress in September as an important item for discussion. Many a valuable plant has been lost, supposedly due to dry or wet rot, whilst all the while the cause has been eelworm.

References: M. of A.F. advisory leaflet 284. Potato Root Eelworm.
M. of A.F. advisory leaflet 307. Root-Knot Eelworm in Greenhouses
M. of A.F. advisory leaflet 319. Soil Sterilisation. Item: Sterilisation of small quantities.
Gardening Illustrated, January, 1955. Soil Sterilisation Report of National Institute of Agricultural Engineers.

FROM ALABAMA

I have some native cacti that are most spectacular when in flower. My front yard, where I keep my plants in the spring after the cold is over, is a sight never to be forgotten. The flowers run from very pale yellow to dark yellow and some have orange and red centers. One plant that I collected in 1953 had 80 buds; the pads were small, slightly round and the 2½ to 3 in. flowers were medium yellow orange with red center. These plants creep or spread over the ground. There is another clump nearly four feet across which will have about 60 flowers; the pads are round and up to four inches. Here is a rare plant for Alabama: the pads are oblong and up to six inches long but most are shorter; the yellow flowers are 3¼ in. across and open the second day and if you bring it inside under artificial light the flowers stay open all night. I have an Easter Lily Cactus (*Echinopsis*) over a foot high and six inches in diameter; the flowers are white and fragrant; last year I took 144 pups or offsets from the big plant and 4 small ones. The plant is about ten years old and flowered for the first time last year. It takes full sun or it grows too tall and spindling. I have an *Epiphyllum strictum* eight feet across and last May it had 75 flowers.

JOSEPH WOOD

INSECT HEROES NOT WELCOME IN SYDNEY

The famous insect that helped Australia overcome its prickly pear menace nearly thirty years ago, has invaded Sydney.

But now, instead of being welcomed as a hero, it assumes something of the role of a pest.

These *Cactoblastis* have been attacking cactus plants that were being specially cared for as horticultural specimens.

Government experts cannot decide just how they got into the heart of the city, although one theory is that their eggs may have been on plants introduced from the country.

There seems to be no record of *Cactoblastis* ever being liberated in Sydnev by the authorities in the past, nor have anv been seen outside the preserved ones in museums.

The most unexpected point of this invasion was the City's Botanic Gardens, where the *Cactoblastis* made a wreck of a number of prickly pears in pots intended for exhibition at the Royal Easter Show.

This happened a couple of months ago but a little earlier other *Cactoblastis* had also appeared "out of the blue" in a cacti fancier's garden at Cronulla. In both instances no one recognised the insects.

Entomologists of the department of Agriculture started investigations and revealed the true identity of the culprits.

Mr. Laurie Pratt, a department field assistant, visited the Botanic Gardens and there found the unmistakable caterpillars of the *Cactoblastis*. Numbers of them had riddled the fleshy insides of the prickly pear "leaves". Each grub was little more than an inch long and plump with a striking orange colour crossed with lines of black spots.

Officials of the Prickly Pear Destruction Commission are equally uncertain about this novel invasion. They say that the nearest area to Sydney where *Cactoblastis* have been liberated in the past is out around Camden. No breeding stocks are kept in the city.

Incidentally, the use of *Cactoblastis* today has been largely superseded by poison sprays. There are, however, still many of these insects in country "Pear" districts.

The first batches of *Cactoblastis* were imported here in special cages from America in 1925. From these our experts bred many millions and liberated them throughout Queensland and New South Wales.

There they formed, with conspicuous success, the main attack on our greatest and most costly plant menace, which thirty years ago had spread its prickly jungle over an area af Eastern Australia that exceeded the area of Great Britain.

The above extract, from a Sydney newspaper, was sent by Mr. W. Ruggles, Hon. Sec. South-East Kent Branch to the National Cactus and Succulent Society, England.

QUESTIONS and ANSWERS

Conducted by
HARRY JOHNSON
Paramount, Calif.

Question: Please tell us how to fumigate our greenhouses and collections in preparation for bringing in our plants for winter.

J. M. RILEY, Ga.

Answer: There are several preparations on the market that may be purchased for fumigating. Some of the best are based on Malathion. They come under various trade names. Some are smoke bombs in cans or containers ignited by Fourth of July sparklers which fill the house with white smoke. Others are pressure bombs by which you can release a graduated amount to fit the cubical capacity of the greenhouse. They are simple and easy and do not require expensive equipment to apply thoroughly. Many greenhouse operators swear by them. My own experience is for spraying but using high pressures i.e., about 300 pounds. This requires rather expensive and heavy equipment. A good hand sprayer for small greenhouses is the Hudson No. 310-B which holds three gallons. A two and a half gallon size can be had. The pressures, of course, are low but the coverage is good and they are very useful for many things around a greenhouse such as watering fine seeds, etc. They are trouble free for years.

Question: As it freezes very hard here, I dug up my cactus plants and put them in a cardboard box. How long will I be able to keep them without water and dirt?

MRS. JIM LAWHEAD, Mo.

Answer: Cacti vary greatly in their ability to take prolonged drying out. Quite likely, if the plants are in a cool, well lighted place where the humidity is reasonable, say about 40, they will come through in good shape. It would be better to pot them in a very open soil such as sand with a little leafmold added or even in peat moss. In the peat moss, they don't seem to have a tendency to rot and often root freely.

Question: My plants of *Lithops,* Mexican Living Rock, and Tiger Jaws are growing well now after their July and August rest. The *Lithops* did not flower but has two new leaves and the Tiger Jaws has four. They do not seem to want to stop growing. What treatment should they have during the winter? The Orchid Cactus that I got in August has not shown signs of new growth.

MRS. M. H. MIARS, Mich.

Answer: The three plants need somewhat different treatment as the conditions under which they grow in the wilds are not parallel. *Lithops* and Tiger Jaws, of which there are many species of each, are natives to South and West Africa. This is a very large area with many differing climates due to elevation and mountain ranges. Some have summer rains and dry winters, others have winter rains and dry summers, and some are in fog areas or have coastal climates. Soils, exposures and winds make an endless variety of habitats. Actually, in cultivation, *Lithops* of most all species seem to do well under the same culture. Most seem to grow where the rains are in summer which, in South Africa, being south of the equator, start sometime after the middle of September which would roughly be their vernal equinox and our autumnal equinox. If you will think of September as our March, the succeeding cultural notes may make more sense. Some plants when shipped north or south of the equator easily reverse their growing seasons or, as we say, respond to periodicity or the successive lengthening or shortening of the day. Many plants are extremely sensitive to these light changes and can be made to flower at any time of the year by artificially shortening (approximating the autumnal equinox) the day. A prime example of course is the Chrysanthemum. Other plants seem utterly determined to follow their old calendar; they are nature's real conservatives! Among them are *Lithops* and *Faucaria.* Thus they still flower in late September, October and into November even though winter is approaching in the north and days are getting shorter instead of longer. So we rest them in June, July, and August withholding water, giving only enough to keep them barely plump—perhaps once every three or four weeks lightly. In September, a little more water can be given—not a sudden soaking but just a little to stimulate their tiny root systems into growth. Buds will begin to show in late September or October depending somewhat on the species, somewhat on how rough the summer rest has been. After the flowers, the seed pods form if plants have been cross pollinated. No growth should be visible as regards new leaves. Now the trick is to keep them plump, but not turgid, until spring. If they get turgid from an excess of water the new pair of leaves will burst apart the old pair splitting them up the side and emerging through the split. Well from the standpoint of good culture they have had it! You have not lost your plant but spoiled its symmetry for this year. Next year you will know better and can repair the fault. The new pair of leaves should be slowly absorbing the old pair and will not be visible until later. In February, March, or even later, the new pair will slowly become visible with the old pair having been absorbed until

as the dry season approaches they are a paper-like covering over the new, brightly colored pair. Since you want to see your plants, the old paper-dry coverings can be removed for the summer, though in nature, if undisturbed, they probably remain until the rains come later. When the *Lithops* bloom, they often, but not always, develop two sets of leaf buds at the base of the flower stalk. Thus the flower is actually terminal and the new growth lateral, sometimes sympodial. The woody stem of *Lithops* has been reduced to what amounts to a thin plate at the apex of the root. With age it elongates a little. Thus the plant that one sees is actually only a pair of connate, succulent leaves.

Other genera of the group, called Mesembryanthemums, that have like growth characteristics and are liable to be encountered in collections, are *Conophytum* of which there are perhaps two or three hundred now, *Ophthalmophyllum* probably about fifty species and a few odd ones like *Muiria* which is monotypic, *Rimaria,* etc.

However, many other genera should be treated almost exactly the same. They differ morphologically in that they bear more than one pair of leaves at a time or at least so in cultivation. *Lapidaria, Dinteranthus, Argyroderma, Gibbaeum, Cheiridopsis, Didymaotus, Herreanthus, Oophytum,* and *Pleiospilos.* Other more leafy genera also need like treatment. *Titanopsis* (Jewel Plant), *Fenestraria* (Baby Toes), *Frithia, Nananthus, Odontophorus,* etc. etc.

Faucaria or Tiger Jaws seems to favor regions of a little more rainfall though in general it may have similar treatment.

The Mexican Living Rock is a true cactus, *Ariocarpus fissuratus,* and requires very different treatment. It is a native to south west Texas and adjacent regions of northern Mexico. It can stand almost zero weather probably several degrees below. The rains come principally in the form of summer thunder showers which can be pretty violent, not to say damp! However, the soil does not stay wet for long periods and oftimes there are long stretches between rains. Winters are reasonably dry and clear and often cold. Any watering should be in warm weather. With us they bloom about September and often are growing at this time. In winter we find it best to keep them on the dry side. In cultivation they do well in coarse sand with a little oak leafmold added.

Orchid Cacti do not do much growing in late summer. With us they are just starting to show new shoots at the base of the plants in early December. This would probably vary in different locations through our country. Under house conditions in cold climates I would hold growth back as much as possible hoping it would develop later when the days were beginning to lengthen.

Question: What cacti and succulents can be grown and flowered in a greenhouse in a 60 degree night temperature?

JOHN MCINTYRE, Minn.

Answer: Your choice is very large as most of the well known species thrive at such a temperature. I note you plan to grow orchids in the same house. My suggestion is to run the house 50 to 55 degrees rather than 60. It is difficult and expensive to maintain 60 degrees. Every degree less is a decided saving. Through more than 40 years of greenhouse experience I have concluded that many plants can be grown at lower winter temperatures than generally recommended. If you had to maintain a show house of foliage plants, the recommended temperatures are correct. However, most plants need a rest and the coldest winter months are the best for this. I have had a 100′ x 34′ house with a mixed collection of tropical flowering and foliage plants including Medinilla, Philodendrons, Anthurium crystalinum and A. andreanum, Alocasia, Dieffenbachia, Crotons, Gesneriads, Calatheas and Marantas, various orchids such as Dendrobiums, Cypripediums, Cattleyas, Vanda, etc., and cacti, the temperatures often at 50 degrees and for short periods less at night. The evaporation at 50 degrees is a great deal less than at 60 degrees and it is thus easier to maintain the proper humidity. Among the cacti are practically all those grown by collectors. Some may not like the high humidity necessary for the orchids.

Question: Will *Opuntia basilaris, O. aciculata,* and *O. santa-rita* remain small in pots and will they flower?

THOMAS OLIN, Nebr.

Answer: They will stay dwarf in small pots. The dwarfed plants do not flower as well as the normal ones.

Question: My *Stapelia gigantea* had eight buds last fall but all dropped. We had an unusually hot spell at this time.

JOYCE EDWARDSON, Ohio

Answer: Without knowing your general culture, it is difficult to answer intelligently. Somewhat like phoning the doctor and asking the diagnosis of a fever. If the plant is on a window sill with the sun shining through the window glass, it was probably due to the burning sun rays. It may also have been due to improperly matured stem growth, starvation, or lack of sufficient air circulation.

Continued on pg. 34

FROM MAINE

Dear Mr. Haselton:

I am gradually turning to Mammillarias for the most satisfactory species to grow indoors. I have four southwest windows with a wide bottom shelf at window-level and a middle shelf that extends way across the four. The lower half of each window may be raised in summer. I had a lot of trouble from sunburn the first year but have eliminated this trouble by putting screens on the outside of three of the windows which gives just enough shade for those varieties which need it. My present soil mixture which is used for all of my cacti is as follows:

1 part rich garden soil

1 part leaf mold from maples, containing quite a bit of rotted pine needles from a large pine growing among them.

1 part washed sand such as is used in cement making

To each 8 quarts after screening to remove dust, I add a handful of "Hybro-Tite"*

This mixture should provide a complete source of necessary plant nutrients and I am getting very good results from it. Globular plants remain globular and columnar plants increase in height but are not drawn out. Best of all, I get flowers.

At the present writing (Dec. 21) the following Mams. are in bloom or budded: *M. bachmannii, M. schiediana, M. pyrrhocephala, M. tetracantha, M. werdermannia,* and *M. hahniana.*

M. collinsii and *M. galeotii* began blooming in November; the former was in flower for around three weeks and the latter till the second week in the month. Along with the Mams. and related species I have several Gyms. (all flowering size), four large Parodias, a few Notocactus, several Echinopis hybrids, two Astrophytums and an 18-in. *Cephalocereus senilis* which is the sole survivor of the collection that you saw when you visited me years ago.

Can someone tell me how to grow *Mammillaria aureilanata*? I've had three of them but they all "faded" away.

Here's one for "Cactus Ripley" if such a person exists. Two weeks ago a large plant of *Astrophytum myriostigma* put out two buds. Today one of them opened into a lovely two-inch open flower. Outside on the northwest side of the house the thermometer registered exactly zero F.

OLIVER P. YOUNG

* * *

FROM MICHIGAN

Beahm Gardens: I have an "Orchid Cactus" without a name. It has cardboard-thin branches with scarlet, five-inch flowers. What care should I give this plant which seems to be flowering out of season? Should I encourage growth or dormancy? IGM, Michigan.

With reference to your epiphyllum with its scarlet diurnal flower with white stamens blooming as of November, it would seem it is, without doubt, the variety sold commercially as "Poinsettia". This variety makes a lovely basket plant with its wavy flat, non-spiny branches and with its inclination to bloom in the fall as well as other times of the year. To make identity doubly sure the ovary and tube will be much shorter than in most epiphyllum hybrids—the flower quite wide open and the total count of sepals and petals will scarcely ever be more than twenty.

In case this variety must take winter storage in the dark, it of course should not be encouraged to grow. It would be better if it could be kept in a place where it could receive daylight and where temperature remained above 40 degrees. It should be allowed to become moderately dry for a week or so at a time and it is our experience that at no time is artificial forced feeding desired. It is quite capable of making use of the nutrients of the soil in which it is planted provided that soil is complosed of plenty of humus and drains well. It does not take kindly to transplanting or to excess watering but once it becomes well established one should have no further trouble with it.

GERTRUDE W. BEAHM

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*Original U. S. Government (Department of the Interior) Analysis of "Hybro-Tite" from Bulletin 426, United States Geological Survey

	Fresh	*Partly Decayed*
Silica	72.96	74.53
Alumina	14.70	13.70
Iron Oxide	1.28	1.15
Magnesia	.07	Trace
Lime	1.28	.95
Soda	4.18	4.41
Potash	4.73	5.20
Ignition	.23	.81

Georgia Institute of Technology. Test of Average Lot of Lithonia Granite (Hybro-Tite) made December 19, 1951, by Dr. Alfred T. Navarre, Associate Professor of Geology

Strong	*Fair Amount*
Potassium	Strontium
Aluminum	*Weak or "Trace"*
Silicon	Yttrium
Sodium	Silver
Titanium	Zinc
Calcium	Zirconium
Phosphorus	Lead
Less Than Strong	Chromium
Magnesium	Nickel
Medium	Vanadium
Iron	Copper
Manganese	

MIA HOMO SPAIENS

A True Story of My Man, or, Life With a Cactus Fancier

Out in the Texas Panhandle, we were moseying along looking for pincushion cactus, *Echinocereus viridiflorus* to him. We saw a large badger, *Taxidea taxus* to him, waddling across the highway. The brakes squealed, out he got, the chase was on. The badger beat him to the hole. I had to tote a huge rock a hundred fifty rods to stop the hole. Back to the shanty 19 miles back we went, loaded up 11 gas barrels, drove to a buffalo wallow and filled the barrels with water. Back to the hole we went, in went the water. I know now what is meant by the old saying, "like pouring water down a praire dog's hole." No badger! Badger stock was at a very low market all the way back home. BUT don't think a badger can't be caught barehanded away from his hole. Mia Homo caught four nice specimens barehanded for our local zoo, the past three years. Homo Sapiens will try anything.

At Okeene, Oklahoma, at the last Rattlesnake Roundup, we were looking for rattlesnakes, *Crotallus confluentes* to him, and also for pincushion cactus, *Coryphantha aggregata* to him. We picked up several bull snakes, *Eutaenia proxima* to him, and ran across a large rattlesnake in the rocky hills. We had to move huge boulders with a Johnson Bar and also be careful not to injure the snake. He wanted a "beautiful picture of him in a striking pose." We heaved rocks till we gave out. No snake. We picked up some nice cactus and brought back two large tarantulas, *Mygale hentzii* to him.

Near Burleson, Texas, we hunted for fishhook cactus, *Hamatocactus septispinus* to him. Definite directions we got from the man who said, "Go this away and then thataway, bend in road like elbow, Oak tree with squirrel hole on that side and turn again to big mesquite tree, go left in pasture, plenty cactus there." We got lost but Mia Homo said, "Don't worry we will find 'em yet." We slept in the truck that night. Next day no cactus. That afternoon a hundred miles further down the road near Beeville, Texas, we ran into them on the highway, accidentally. Without hunting for them we picked up about a dozen nice specimens!

A man wrote a letter from near Seymour, Texas, (being a woman, I opened it by mistake). "Will be spraying mesquite next week, if you want any nigger heads come down and get them." As soon as we could grease up the truck we were on our way. At dawn we enquired where we might find the man. Found out he was spraying mesquites two counties over, so we returned without any niggerheads, *Homalocephala texensis* to him.

In the Santa Rita Mountains of Arizona, we were looking for rainbow cactus, *Echinocereus rigidissimus* to him. We ran across a huge desert turtle, *Gopherus berlanderii* to him. We fetched him down the mountain, put him into an apple box. Near Santa Rita, N. M., later we stopped to look for cactus. Some Mexicans had turtle soup for dinner, because both the box and turtle disappeared. He didn't say any prayer words to that, but it saved him the job of polishing the shell.

At Rancho Maria in Western Oklahoma, prickly pears, Opuntias to him, get thick and nearly take the grass over. Past few years pincushion cactus, *Coryphantha vivipara* to him, also increased to the point where the bullets and cowlets bawled out complaints about the cactus. Finally I persuaded him to go dig them out. (U. S. Govt. paid him a dollar an acre for this.) A two day digging contest was on and we hauled and dumped away two large trucks full of "those nice plants." We kept about 25 nice clusters, some for our own garden, others to give away. I had to load huge clusters, some with 76 heads, as large as bushel baskets (his back was weak ,so he said) on the truck. I now see the grass as seen through a bull's eye.

FIG. 8. *Clearing Oklahoma grazing land.*

Wherever we roam he always makes for the ancient dump grounds. To find Desert Glass, so he says. Usually I find him bringing back odd containers for his cactus plants. He has a collection of over a hundred of all shapes and sizes. We do find nice colored bottles now and then.

Out at the Panhandle, Texas, ranch we double disked a twelve acre lake, to kill the grass and weeds. Later we harrowed and disked the weeds to pulverize them. When the rains came the water floated the humus to the south bank of the lake and we winrowed the humus, hauled it to a pile, threw some dirt, soil to him, on the pile. Last winter we hauled a wheat truck full of the compost home, 260 miles away. "Best compost for cactus" so he said.

Mia Homo Sapiens has made me laugh many a time at some of his ridiculous thoughts and deeds, but on the other hand he is a pretty fair old chap. If I'd a hooked some other one, he might have turned out to be a monkey collector. So I guess I can't complain. I've seen thousands of miles of beautiful desert country, climbed mountains like a goat, seen myriads of beautiful flowers, and made hundreds of friends.

I have often stood and gazed with admiration upon a panorama of magnificent views. It's utterly impossible to describe the sensation that came over me and the exquisite pleasure I have experienced as I gazed upon these grand and novel pictures.

Mia Homo has a nice collection of plants, very pleasing to the eye. So I have no complaint to make, and, come fall again, he will be on the move again. I have advance notice, so my little gunnysack is all packed and my walking stick will be handy.

Cacti Fanciers Wife.

MARIA POLASKI, Oklahoma City.

Factors in the Control of Flowering

By Louis E. Blanchard

Box 67, Crystal Beach, Ont., Canada

It is spring. The crocus emerging through the March snow heralds the season with its glory. A host of other plants will burst into bloom with the changing year. This panorama of floral grandeur is not a haphazard profusion of flowers; it is an orderly sequence in which each variety develops an irresistible urge to bloom at a predictable time of its season. What is this controlling power, so precise and so punctual, that compels violets to bloom in the spring, lilies in the summer, and asters in the fall? What dominating force abruptly induces a plant to change its mode of life from a strictly vegetative form (leaf and stem growth) to a reproductive stage of flowering and fruiting?

This phenomenal differentiation of the growing bud is induced by two sets of interreacting factors—*environmental* and *specific*. Environmental factors, such as nutritional balance, favorable temperature, and light intensity influence the time of flowering by its effect on the rate of vegetative growth and food storage. Although such factors are nonspecific in their action, they nevertheless promote earlier flowering when they are favorable; they retard or even suppress blooming when they are biologically antagonistic. Limited light and subnormal temperature adversely influence vegetative growth and flowering. Due to seasonal variations of light, three months of summer growth is equivalent to five months of winter growth in northern greenhouses. At a temperature of 55°F, neither chrysanthemums nor poinsettias initiate buds at their normal blooming time. Environmental factors have definite modifying effects, but *never* initiate or control flowering.

Plants require a definite amount of growth before expressing their maturity by bloom. This may require a few weeks for annuals, or many years for certain perennials. Stocks (*Mathiola incana*) are sufficiently developed for floral initiation after they have formed at least ten leaves, providing the conditions are favorable. *Auxin* is the hormone which regulates vegetative growth, and as long as conditions are favorable for auxin concentration, the plant growth will be vegetative.

The century plant (*Agave americana*) affords an excellent example of the relation between food storage and flowering. This succulent plant blooms but once, and only when it has accumulated sufficient food material for this vital function. Depending on the environment, this may take 5 to 75 years, and its span of life will vary accordingly—but not as long as its popular name implies. When sufficiently developed, it consumes its entire energy in a burst of spectacular floral vigor with an inflorescence up to 30 feet in height within a month; then it dies from sheer exhaustion when its seeds are ripe.

Since flower, fruit, and seed development require large amounts of quickly available food, the mechanism which curtails vegetative growth with consequent storage and diversion of the food supply for vital reproductive purposes, has a genetic adaptive advantage. However, there is conclusive evidence that adequate food supply does not initiate flowering, but is nevertheless significant in the flower and fruit development.

It is definitely established that the floral response is due to the biosynthesis of a specific hormone, and not the nutritional status of the plant. This hormone (*florigen*) is responsible for the abrupt shift from the vegetative to the reproductive phase of the plant's life. The curtailment of vegetative growth that normally consumes most of the food for tissue structure, now leads to food storage for vital reproductive formation and development. If adequate food supply initiated flowering, then cabbages, carrots, and beets grown from seed would bloom during the latter part of the summer when the stored food was at its peak and the weather was still warm. Any prolongation of the warm period is also ineffective for floral induction. Even when such plants are transferred to a warm greenhouse for the winter, they still continue to grow vegetatively. (The specific factors for the floral stimulus are explained elsewhere in this article.)

Greenhouse plants grown under normal conditions of temperature and light, but with excessive nitrates and moisture, produce a lavish succulent growth with delayed blooming. With balanced fertilizers and with water reduced to the adequate amount, the plants are shorter and firm, and bloom earlier, but at their *normal time*. This has led some growers to erroneously conclude that withholding water stimulates blooming. On the contrary, inadequate moisture not only curtails growth, but also delays flowering.

Precocious maturity with premature flowering may indicate disease. In chrysanthemums, this condition is caused by a viral infection known as Stunt Disease. The plants are stunted, and

produce small, early, off-color blooms.

Kraus and Kraybil (1918) emphasized the significance of the carbohydrate to nitorgen relation in the tomato plant. With normal light, abundant water, and excess nitrogen, the plant responds with excessive vegetative growth but no bloom. If nitrogen is withheld, the carbohydrates accumulate, as they are not consumed in the synthesis of protein; therefore the plant response is both nonvegetative (short and woody) and nonfruitful (no bloom). The plant is in similar distress but with frail growth (short and slender) when the nitrogen is abundant but the light is inadequate for normal photosynthesis; here the carbohydrate production becomes too low for the adequate synthesis of protein essential for growth. Only in nutritional balance will the response be both vegetative and reproductive—in adequate light and with moderate amount of available nitrates.

All of the elements involved in plant growth are of vital importance. Physiological balance requires the *adequate* and *simultaneous* presence of all the building materials. Each nutritional element can function only in conjunction with other nutritional ingredients. Each component resembles a link in a chain. The absence of any single link destroys the function of the others. In the winter, the factors for nutritional balance in northern greenhouses differ from those of summer even for the same type of plant. The northern winters have a maximum of 9 hours of sunshine versus 14 hours in the summer. Cloudy days and low intensity of light further reduce the available sunshine. The amount of mid-winter (Dec.-Jan.) light is less than 30 per cent of that in June.

Plants should not be forced beyond their photosynthetic capacity to produce food. Water and fertilizer should be reduced in relation to diminished sunshine. Lower temperatures should be carried to retard respiration. The plant's reserve (sugar) is at its lowest and rigid economy is essential. Even with maximum sunshine, unless the greenhouse ventilation is adequate, photosynthesis may be retarded due to limited carbon-dioxide. Excessive fertilizers, water, and high temperature have a pernicious influence which affect crops in various ways. In snapdragons, such overforcing produces stubby, terminal spikes with 5 or 6 half-open flowers on soft hollow stems. Such flowers are very short-lived. Many of the flower-buds cannot develop due to the blasted condition of the anthers, stigma, and petals caused by starvation. Overforcing of chrysanthemums produce small, soft, faded blooms on thin, hollow stems that frequently are too weak to support the flowers. Borderline deficiencies may not result in immediate death, but always produce a condition of suboptimal health. Such debilities result in low resistance, distorted and retarded growth, and sterility.

Specific factors in the control of flowering, such as day-length (*photoperiod*) and low temperature, deal with genetic adaptations. The effects of day-length on plant growth has been known for many years. Laurie and Poesch (1939) credit John Ray with the first record on this subject. This observer in *Historia Plantarum* (1686) described the differences induced by light variation. H. A. Allard (1944) states that A. Henfrey in his book "The Vegetation of Europe" (1852) comments that day-length was the factor which controlled the natural distribution of plants. Klebs in Germany (1913) concluded from his experiments that flowering in *Sempervivum funkii* was dependent on day-length. He could not induce flowering by nutritional or temperature changes, but the plants produced flowers after several days of continuous artificial illumination. The control non-lighted plants remained vegetative. However, the fundamental principles of photoperiodism dates back to 1920 when Garner and Allard of the U. S. Department of Agriculture published their famous investigation on the effects of day-length and its relation to vegetative and reproductive growth. These observers noted that a new variety of tobacco (Maryland Mammouth) in contrast with other varieties, remained in a vegetative condition throughout the open growing season at Washington. When the weather became cold some of these plants were transplanted in the greenhouse where they bloomed and developed seed in the winter months. During summer outside growth, these tobacco plants attained a height of 15 or more feet with many leaves; however, when grown in a greenhouse in the winter months, they invariably bloomed at less than 5 feet in height with relatively few leaves. It became obvious that the season of the year in which the Mammouth tobacco grows determines its giant character. They also observed that multiple plantings of soy beans at frequent successions in the spring and early summer flowered simultaneously. They concluded that the time of blooming in light-sensitive plants was determined by the *duration* of the daily illumination rather than its amount. It is this significant distinction that credits Garner and Allard as the discoverers of photoperiodism. The botanical world was indeed amazed that such a seemingly insignificant factor as duration of light could exert such a profound influence on plant development. The previous investigators considered day-length only as a quantitative factor of light, and there seemed to be no physiological basis to consider it otherwise.

FIG. 9. *Hylocereus undatus* produces exotic blooms at its inductive night-length which varies with the latitude.

Plants that are sensitive to the length-of-day factor—technically known as *photoperiodism*—are adapted to change from the vegetative to the reproductive stage at a specific day-length characteristic of the species. The range of day-length varies with the season—from 15 hours in the summer to 9 hours in the winter in temperate regions. Short-day plants will only flower in photoperiods shorter than their critical day-length, and vegetables when the light exposure is above it. In a precisely reverse response, long-day plants promote flower formation only when the daily light exceeds the critical day-length, and vegetate when the exposure is below this day-length value. Plants (e.g., chrysanthemum, dahlia, poinsettia) that bloom in the late summer, autumn, and winter are *short-day* plants; radish, lettuce, and annuals grown for spring flowering are *long-day* plants; the tomato, rose, and carnation belong to the *day-neutral* or *indeterminate* group which blooms at all seasons irrespective of *day-length*. The life cycle of day-neutral plants proceeds as fast as their food supply and growing conditions permit.

Strictly speaking, the critical factor in photoperiodically sensitive plants actually depends on *night-length* rather than *day-length* for floral induction or its inhibition. The terms *long-night* and *short-night*, rather than short-day and long-day, are truly descriptive and logically should be the proper classification. Day-length, *per se*, does not control flowering, but it does indicate the relative night-length following a photoperiod. Interrupting the light period does not interfere with blooming; a break in the dark period of long-night plants inhibits flowering.

Floral initiation depends on the formation of a specific hormone (*florigen*) produced in the leaves. Its biosynthesis requires two sets of interreacting changes; one requires light, and the other darkness. The effects produced in the light (photochemical reactions) are quickly com-

pleted; the chemical changes occuring in the dark are sensitive to light and are reversed by it, and therefore need a long time for completion. The reactions that occur in the dark cannot take place without the preceding photochemical changes.

The time mechanism for the production of florigen in long-night plants may be briefly described as follows: after June 21st., the nights are gradually longer, and the days are correspondingly shorter. At first, there is decidedly more than enough light to nullify or reverse the chemical reactions occuring in the dark. With the advancing season, the day arrives which requires its entire light period to completely nullify the florigen produced in the dark period. This represents the plant's *critical night-length*. With the lengthening night after this critical dark-period, more florigen is produced than can be inactivated by the progressively diminished light in any 24-hour period. The plant is now in its *critical flowering period*. At this time, flowering is possible because the proper balance of the continuously changing light-dark ratio is increasingly favorable for floral induction.

The minimum dark-period duration shows a wide variation in accordance with the innate character of the species. The regular alternations of periods of light and darkness are essential. The preceding light reactions (*photosynthesis*) produce the essential complex building materials and energy for the reactions in the dark. The regulating condition is a properly balanced composite factor—light and darkness. Several hours of midday darkening of long-night plants will not affect the time of blooming. On the other hand, a break of only 1 to 15 minutes will prevent flowering of sensitive plants in a dark period that would otherwise be sufficient for floral induction. Under natural conditions, plants receive much more light than they require for flowering. Thus the controlling factor in the critical flowering period is the length of the *longest continuous dark period* in any 24 hour cycle, and not the total period of either light or darkness.

About 1-3 hours (depending on the night length) of lighting of only 8 foot-candles capacity in the middle of the dark period will prevent bud initiation in chrysanthemums. Such faint light has no measurable effect on photosynthesis. It merely converts one long-night into two short-nights, but does not change the day-length. The *critical night-length* is the darkness value separating the inductive from the noninductive ranges of dark periods. As long as the induced short dark periods are each less than 9½ hours (critical dark period for chrysanthemums), the plant will remain vegetative; if longer than 9½ hours, buds will originate. Shading chrysanthemums with black cloth in the late afternoon to produce *continuous* darkness longer than 9½ hours, will initiate flower-buds even in the longest days of the year.

It is apparent that there is a definite relation between the growth-promoting hormone (*auxin*) and the flower-promoting hormone (*florigen*). Excess auxin appears to promote vegetative growth and inhibit flowering. In long-night plants the concentration of auxin apparently falls during the dark period and eventually reaches the level where the synthesis of florigen takes place. The excess florigen now inhibits vegetative growth and promotes floral induction.

Inasmuch as appropriate night-length is the floral inductive factor, it would seem that spring-flowering plants, such as wild strawberries, should bloom again in the fall at the corresponding dark period. Such off-season bloom is usually present and can produce fruit, unless killed by frost. Due to some environmental condition (e.g., nutrition, cold, drought), a small percentage of the plants do not develop sufficient maturity for bloom at their spring flowering period. However, when they finally reach maturity, their critical floral period has passed, and the plants remain vegetative. In the fall, at their inductive night-length, such tardy plants respond with their first bloom.

Plants are genetically adapted to one complete reproductive cycle in a year. It requires a full growing season and all available energy for adequate growth, food storage, and seed production. In spite of two critical flowering periods for spring plants, there is only one floral response; the necessary combination of all the essential factors for a second reproductive cycle is seldom present.

The seasonal time of blooming of short-day plants in their respective localities will vary with the latitude—in the direction north and south. Plants that bloom early in one part of the country, may be late in another. The type of Christmas cactus, *Schlumbergera bridgesii*, which flowers at Christmas in the region of Buffalo, N. Y., will bloom a month later in Miami, Florida.

After the autumnal equinox (Sept. 23d), the days get progressively shorter in the direction northward from the equator, until there is continuous darkness for 6 months in the circumpolar region. The opposite holds true in the summer season—the days are progressively longer, until there is continuous sunshine for 6 months in the Polar region—the land of the midnight sun. At the equator, the dark and light periods are about 12 hours with only slight winter and summer variations. The daily light and dark periods are due to the earth's

revolution on its axis every 24 hours. The relative lengths of these periods depend on the degree of inclination of the earth's axis and the position in its orbit in its yearly journey round the sun.

One would expect a given variety of chrysanthemum planted on the same date, to flower earlier in balmy Florida than in New York. Paradoxical as it appears, the reverse is true. In New York, the critical dark period of 9½ hours arrives about 1 month *earlier,* and accordingly the plant blooms that much sooner. However, the chrysanthemum in Miami at blooming time will be at least a foot taller, as it had an extra month of vegetative growth.

Chrysanthemums normally bloom in the late autumn when the nights are long and the days are short. Commercial growers, however, now force these plants into bloom even in the long days of spring and summer. This is done, not by increasing the light but by daily *darkening* with black cloth or fibreen paper to obtain the critical dark period for floral induction.

The poinsettia is native to the tropics and its critical dark period is 12 hours. At about 42° N latitude (near Buffalo, N. Y.), flower-bud initiation occurs about October 20th and the plants must be grown in greenhouses. It is impossible for poinsettias to flower normally outdoors in northern gardens as they will be killed by frost before reaching their critical dark period.

The flowering dates of photoperiodically sensitive plants are genetically geared to the solar clock for blooming on a fixed schedule. The face of this huge imaginary clock is the earth's orbit around the sun. The position of the earth in this orbit represents the hand of the clock, and it indicates the season of the year which controls the succession of bloom.

Regardless of locality and diversity of flowering dates, all photoperiodically sensitive plants bloom *on schedule—at their critical flowering period.*

Another factor that modifies flowering is temperature variation and its effects on chemical reactions. The crucial factor in biological temperature requirement is the effect of heat on specific enzymes. Like chemical reactions in general, their activity is doubled for every rise in 10°F under normal conditions. Enzymes are unstable in excess heat. The diversity of this instability will vary with the genetic temperature adaptation of the species, and for this reason certain plants can only grow within narrow limits of temperature. A temperature of 50°F is beneficial for stocks, but fatal for coleus. Neither would live in the excessive heat of the desert, where cacti flourish.

At temperature above the optimum, the rate of chemical reactions decreases due to the inactivation or destruction of essential enzymes.

FIG. 10. At its inductive night-length the *Echinopsis* produces its spectacular flowers.

In short exposures to excessive heat, the recovery may be complete on cooling, but if the exposure is prolonged, certain enzymes may suffer partial or complete irreversible destruction. For this reason, high afternoon temperature in greenhouses will delay the flowering response of chrysanthemums. In mild heat of 105°F, the blooming period may be delayed several weeks beyond the anticipated schedule. With peak heats of 110°F this retardment may be four or five weeks. Severe heat partially inactivates essential enzymes and the plant responds with small misshapen blooms which frequently do not fully open. In the southern part of the country where afternoon temperature peaks in greenhouses may rise to 120°F, the growth of chrysanthemums is impossible due to total inactivation of the floral hormone. At high temperature, additional damage occurs from the loss of sugar due to excessive respiration. The loss is negatively correlated—the higher the excessive heat, the lower the sugar content.

Plants are economically adapted to the *diurnal thermoperiodicity* of higher day temperature and lower night temperature. This is conducive to high sugar production during the day, and low sugar consumption at night due to diminished respiration in a cooler atmosphere. House plants do not thrive when grown in homes at a

constant thermostatically controlled day and night temperature.

Low temperatures have a specific effect in the cyclic responses of deciduous trees, shrubs, and rhizomatous plants in temperate climates. In such plants, development is only possible when periods of high temperature alternate with periods of low temperature, such as take place in the summer and winter seasons. Cut branches in water from a tree or shrub in its period of rest before chilling, will not develop shoots even under the favorable conditions in a greenhouse. In later winter, after an adequate chilling requirement, cut branches from the same tree will rapidly develop new growth. Without the rigors of winter, there could be no glory of spring. The pathetic fallacy of believing that plants suffer in harsh winter weather has no physiological basis.

The rhythm of *annual thermoperiodicity* requires a year under natural conditions, but can be shortened (or lengthened) by controlled succession of temperature. Unless deciduous trees, such as pears and peaches, are subjected to low temperatures (near freezing), they will not break their *rest*. This rest is not a dormancy or quiescence induced by adverse external conditions, such as unfavorable temperature or inadequate water supply; it is a suspension of growth genetically biochemical in nature, and persists under favorable growing conditions. Chilling favors a growth-promoting hormone in the buds or removes the inhibitors of growth. Starch hydrolysis with sugar formation at low temperature may assist nutritionally in promoting this response.

Deciduous trees and plants that are genetically adapted to northern climates cannot be grown in subtropical regions. It requires temperatures of 5°-8°C to break *rest,* and these temperatures must last a definite number of hours which varies with the species. The required cool hours need not be consecutive as the chilling effect is cumulative. Varieties native to northern climates require a longer chilling period. Such species when grown farther south where there are fewer cool days, will require a longer period to break rest and will thus show delayed foliation. By contrast, native southern species with minimal chilling requirements, when grown farther north may break their rest so early as to be killed by frosts. Plant migration is definitely influenced by annual thermoperiodic adaptation.

Lily bulbs (Croft and Creole) for greenhouse culture are packed with peat in cases and kept in cold storage for about 5 weeks at 35°-50°F before planting. This procedure does not permit uniform cooling, and the more protected bulbs will respond with later blooming. Beet roots, cabbages and onions will continue to grow vegetatively unless they are subjected to cold treatment. These plants may produce flowers in one season like annuals if they are planted early enough to be checked by frost. A biennial is a plant that is genetically adapted to annual thermoperiodicity. Under controlled succession of temperature (cold and warm), a biennial grows as an annual.

Gassner (1918) discovered that controlled cold influences the flowering of cereal plants. Winter wheat or rye, when planted in the fall, germinates during the winter and flowers in the following summer. When sown in the spring, it grows vegetatively but never reaches the flowering stage unless the germinating seed is chilled for several weeks at near freezing temperature before planting. This method of converting *winter* cereals into *spring* types is appropriately known as *vernalization.*

Eventually precise floral initiation of physiologically receptive plants may be chemically controlled. In Hawaii, where the seasonal variations of dark periods and temperatures are slight, pineapple plantations are sprayed with the synthetic hormone naphthalene-acetic acid to induce uniform flowering and to economically control crop succession.

SUMMARY

Seasonal flowering is not a haphazard succession of bloom, but an orderly sequence that is predictable. Environmental factors, such as nutritional balance, favorable temperature, and light intensity have modifying effects on floral induction. Specific factors, such as night-length and low temperature, initiate and control flowering. The flower-promoting hormone (*florigen*) is produced only in a functionally balanced light-dark ratio—when the florigen is sufficient to inhibit the function of the growth-promoting hormone (*auxin*). The light reactions (*photosynthesis*) must precede the dark periods. This provides the essential complex building materials and energy for the reactions in the dark.

The time of blooming of photoperiodically sensitive plants in their respective localities will vary with the latitude, but they all bloom *on schedule—at their critical flowering period.* The sequence of cold winter and warm summer temperatures is a requisite for most plants in temperate climates. Controlled temperature sequence can change a biennial into an annual—winter wheat will grow as spring wheat when the seed is chilled before planting.

Excessive heat delays or inhibits flowering by enzyme inactivation and undue loss of sugar. Hormones initiate and control the various physiological functions. Synhtetic hormones are now used to induce uniform flowering and to control crop succession. Nature's dynamic mechanism is a precise system governed by intricately interrelated biochemical controls.

The Crassulaceae and Cytotaxonomy

By CHARLES H. UHL

Cytotaxonomists are interested in two general sorts of things. First, they seek to apply cytological data to the solution of particular taxonomic problems, especially in cases where judgments based on other kinds of data do not agree. (For example, does species X belong in genus A or in genus B?) Second, cytotaxonomists are interested in determining the nature of the changes in chromosomes that have accompanied evolution and in establishing, where possible, the role that each type of change has had in evolution.

The Crassulaceae are admirable for both types of cytotaxonomic study. On the one hand, authorities have differed very greatly in their treatments of many groups and in the number of species and genera recognized. Thus there are many taxonomic problems in need of new kinds of data. On the other hand, the chromosomal diversity within the family is enormous, providing a great amount of valuable evidence to the taxonomist and to the student of chromosome evolution.

In most species of Crassulaceae the chromosomes are small and appear very similar, and identification of individual chromosomes by their appearance is difficult, not to say impossible. However, the enormous diversity in chromosome number more than makes up for this deficiency. Thus far every gametic chromosome number from 4 to 38, as well as a great many higher numbers, has been found. At least ten species have gametic numbers higher than 100, and two species of *Graptopetalum* probably have 192, apparently the highest number yet known to occur naturally in flowering plants.

Not only do members of the Crassulaceae differ greatly in chromosome number, but also they differ in the patterns of their variation in number. Evolution in the family has evidently involved many kinds of chromosome change, with different emphasis in different groups.

In some taxa there has been very little change in number with evolution, the only variation known being a few eutetraploids. For example, the South African genus *Cotyledon (sensu strictu)* and the closely related *Adromischus* both have a basic complement of 9 faily large chromosomes (cf. Uhl, 1948). The only exceptions yet known are a few tetraploids in *Adromischus* (Hutchison, 1953, and unpub.) As a second example, *Monanthes*, *Aeonium*, and *Greenovia* of the Canary Islands all have 18 small gametic chromosomes, except for a few tetraploids with 36 (Unpub.)

In California, a similar situation prevails in *Dudleya* (including *Stylophyllum* and *Hasseanthus*), except that polyploidy is much commoner and has reached a higher degree. Over one-third of the more than 300 populations studied have been polyploid, one being 14-ploid, but only strict multiples of 17 have been found (Uhl & Moran, 1953). Though *Hasseanthus* has been placed by some authorities (e.g., Berger, 1930) in a different subfamily, its chromosomes are not visibly different from those of *Dudleya* and *Stylophyllum*, and fertile hybrids with normal meiosis occur between *Stylophyllum* on the one hand and both *Dudleya* and *Hasseanthus* on the other, evidence of very close relationship.

In each of the three general examples just cited, the cytological evidence suggests close relationship within each group and fails to support generic segregation. Any decision to maintain all these as separate genera must be based on other evidence.

In other cases, the basic chromosome number differs within a genus. In *Crassula*, most species have 7 gametic chromosomes, though a well-developed polyploid series based on this has evolved (Uhl, 1948). However, a few species have 8 chromosomes, and this is the basic number of a smaller polyploid series. Most kalanchoes have 17 chromosomes, or a multiple, but some are based on 18, and one has 20 (Uhl, 1948). Both in *Crassula* and in *Kalanchoe*, the significance of the different basic chromosome numbers with respect to taxonomy is not yet known.

In still other groups the basic chromosome number is not at all clear. In *Sempervivum*, plants with 16, 17, 18, 19, 32, 36, 37, 38, and 40 gametic chromosomes occur (Unpub.). In *Villadia* (including *Altamiranoa*), species with 11, 12, 15, 21, 23, 25, 33, 44, and 89 chromosomes have been found (Unpub.). Except for *Sedum*, which is highly heterogeneous both morphologically and cytologically, the prize for aneuploidy at the moment goes to *Echeveria*, where gametic numbers of 12, 13, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27, 28, 30, 32, 34, and up to more than 160, are known (Unpub.). In some of these cases species thought on other grounds to be related have the same or obviously related numbers. In other cases they do not, and it is not yet clear whether they can be arranged into new groups that would make any sense when both morphology and the chromosomes are considered.

Obviously the Crassulaceae have had a very diversified evolution, at least as far as visible changes in their chromosomes are concerned, and various groups in the family are at different stages in the development of their particular patterns. However, we by no means fully understand all the patterns of chromosome change that have accompanied evolution in the family.

In addition to these problems concerning relationships between species and genera, many new and unexpected cytotaxonomic problems have been uncovered within species. For example, five of the seven species of *Sedum* native to the eastern United States contain heteroploid races, and the two that do not, *S. nevii (sensu strictu)* and *S. pusillum*, are uncommon endemics. *S. pulchellum* and *S. ternatum* both have 2*n*, 4*n*, and 6*n races* (Baldwin 1942, 1943), and *S. telephioides* has 2*n* and 4*n* (Unpub.). However, *S. rosea*, a glacial relic, has races with gametic chromosome numbers of 11 and 18 (both occurring in New York, Uhl, 1952), and *S. glaucophyllum* has 14, 22, and 28, all in Virginia (Unpub.). In neither of these last two cases has any morphological character yet been reported which is invariably correlated with the difference in chromosome number, though presumably some will eventually be found. Further, apparently the same kind of situation exists in many of the widespread species of *Sedum* in Europe and in the western United States. Thus the Crassulaceae afford much material for those seeking to identify and map chromosome races.

Such cases of apparently intraspecific heteroploidy raise problems concerning the taxonomic recognition, if any, that should be extended to these different chromosome races and, especially, to the various members of a polyploid complex. This is largely because authorities differ in the emphasis they place on various attributes that a taxon should have in order to be considered as a species. Some believe differences in chromosome number, where they occur, are of great-

est importance, since most chromosome races must be unable freely to exchange genes with each other (because, e.g., $2n \times 4n$ gives a sterile $3n$). They believe any taxon established in the wild must be considered a separate species if it is isolated reproductively because of a difference in chromosome number, regardless of its degree of morphological difference or similarity. The taxonomically significant morphological differences, they claim, are the ones, however slight, that are correlated with the chromosome differences.

When it comes to deciding which taxa are species, other authorities are more impressed by the number and degree of morphological differences, though often they do not agree as to just *which* morphological differences are the taxonomically significant ones. Thus they are unwilling to accept as different species taxa that may require chromosome study to be distinguished with certainty. Yet if they insist on clear-cut morphological discontinuities before accepting a taxon as a species, they find, in some of these cases, a morphological continuum containing enough differences, at the extremes, for several species, but lacking

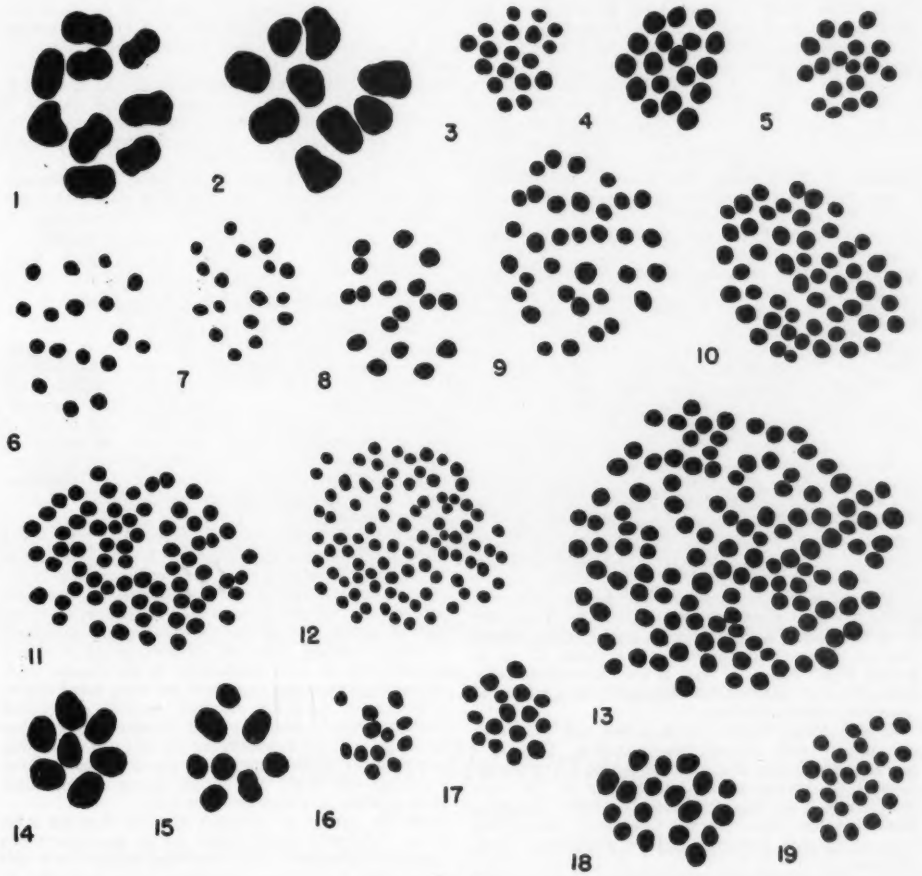

FIG. 11

Fig. 1-19. Chromosomes of some representative species of the Crassulaceae. Camera lucida drawings of first meiotic metaphase in pollen mother cells, X2600. Figs. 1-2, 3-5, 6-8. Similar chromosome complements in *Cotyledon rubrovenosa* von Poellnitz (UCBG 49.1795, n=9) and *Adromischus rodinii* P. C. Hutchison (UCBG50.1181, n=9); *Monanthes laxiflora* (DC) Bolle (UCBG49.1602, n=18), *Aeonium cuneatum* Webb & Berth. (M2132, n=18), and *Greenovia dodrentalis* (Willd.) Webb & Berth. (C47=39, n=18); and *Dudleya (Hasseanthus) blochmaniae* (Eastwood) Moran (M3318, n=17), D. *(Stylophyllum) virens* (Rose) Moran (M1869, n=17), and *D. farinosa* (Lindley) Br. & Rose (M3184, n=17). Figs. 8-13. Polyploidy in *Dudleya: D. farinosa* (n=17), *D. lanceolata* (Nutt.) Br. & Rose (M3386, n=34), *D. greenei* Rose (M3443A, n=51), and *D. palmeri* (S. Wats.) Br. & Rose (M2173, n=68; M2074, n=85; M2186, n=119). Figs. 14-19. Aneuploidy in *Crassula* and *Echeveria: C. teres* Marloth (C48-87, n=7) and *C. marginalis* Soland. (M3191, n=8); *E. teretifolia* DC (C48-63, n=12), *E. nodulosa* (Baker) Otto (U146, n=16), *E. carnicolor* (Baker) Morren (U144, n=18), and *E. pubescens* Schlechtd. (U147, n=23). I wish to express my indebtedness and thanks to Dr. Reid Moran, to Mr. Paul Hutchison of the University of California Botanical Garden, and to Prof. Robert T. Clausen of Cornell, who have identified and collected cytological material of many of these plants.

gaps that would make them capable of clear definition. The heart of the matter seems to be that no one has yet devised a completely satisfactory type of taxonomic treatment for a group of this kind.

Cytotaxonomic study can reveal the mechanisms by which chromosome races have been produced and particularly whether hybridization has been in any way involved. This information, in turn, may make it possible to devise a better scheme of arranging the taxonomic compartments to accommodate these difficult cases that do not fit well into the kinds of units presently available. In the Crassulaceae, with so many problems of this kind, we can reasonably hope that chromosome study will contribute significantly at the same time both to a more natural classification of the family and to a better understanding of the evolutionary process itself.

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ROUND ROBIN NOTES

Two more of the original Round Robins have been accounted for, I am pleased to report. These are C. & S. Round Robins Nos. 4 and 2 (The Flying Saucer). I am still waiting to hear from C. &. S. Round Robin No. 5 as well as the Haworthia, Echeveria, Amateur Exhibitors Robins and others known to have been flying formerly.

C. & S. Round Robin No. 8, a new one, has flown out at last with several new members. This is a Northeastern Robin and could have one or two more members if anyone would like to join it. The new members in it are Mrs. Elizabeth B. Swain, Hingham, Massachusetts; Mrs. Norma Greenhill, Bridgeport, Connecticut; Mr. Lawrence Gallant, Pittsburgh, Pennsylvania.

In regard to the Rain Forest Plants Robin almost all former members would welcome it back. However, the constructive suggestion has been made that in order to make this Robin of greater merit those who wish to join should have wider collections including, besides the usual Epiphyllum and Zygocactus, other rain forest plants as Bromeliads and Rhipsalis. Then, to round out the year and give something to talk about while these plants are dormant, perhaps some fall blooming plants might be included such as Stapelias or the South African mimicry plants. If this Robin appeals to any of you let me know and one will be formed.

Inquiries to join several Robins have come in from New Zealand and Australia where there is a lively interest in cacti and succulents. We welcome them sincerely. We do have a Robin nearly ready to fly there which has room for one or two more in it but I hope the response will be more than that, both from here and overseas.

There have been requests for two advanced collectors' Robins. The first is for a Cactus and Succulent Robin; one that would have international range, and it is suggested it have one member from England, Europe, Africa, South America, Mexico, Canada, the United States etc. If this could be formed it ought to be a most exciting Robin and very worthwhile to those who join it. There is one enthusiast from New Zealand. Let's hear from some others!

The second request is for a small cacti and mimicry succulents Robin. This is not for the interested beginner or those with just a few plants but for those who specialize. I hope the response will be great enough to form two globe-circling Robins. May I have your replies soon?

Lest the smaller collectors begin to feel left out let me hasten to extend an invitation to all those who would like to be in a Robin. For, wherever our Society has members, in whatever country, every one is eligible.

A very happy and prosperous New Year, everyone, and may it bring you joy with your plants, abundant bloom, few problems and the best of friendships.

(MRS.) GLADYS H. PANIS
P. O. Box 705, Falmouth, Mass.

"GROW CACTI" BY C. MARSDEN

Good technical books on cacti in the English language are comparatively few. There is very little informative literature available to bridge the gap between the small beginners' booklets and the standard works dealing with one or just a few genera. Mr. Marsden's newly published book, 'Grow Cacti' will provide a wealth of information for the many thousands of cactus enthusiasts who are past the absolute beginner's stage, but who have not yet penetrated to that stage where only one single genus seems to be worth growing and collecting.

In his book, the first of a series, Mr. Marsden, a chemist by profession, has applied his analytical mind to the many aspects of his spare-time occupation, cactus culture. In the course of 22 chapters, the botanical aspects of cacti, their cultivation in the living-room, out of doors, and in the greenhouse are discussed. Potting, watering, pests and diseases, propagation and grafting are all fully dealt with. In the chapter dealing with propagation from seed we even noted several drawings of seedlings in their various stages and forms. Anybody who has tried to raise mixed cactus seedlings will have experienced the anguish of waiting impatiently for the time when the abnormal-looking seedlings will adopt their normal thorny and succulent shapes, when they may be identified!

On the subject of composts Mr. Marsden has a lot to say, and with good reason for he has done much research on nutrients and soil mixtures for cacti and as a result has become something of an authority in this field.

A novel subject is introduced in this book, which alone makes it outstanding among its few contemporaries: Soil-less culture of cacti. We do not expect that this method of growing cacti will ever be adopted by commercial growers but it is valuable information for the private cactus grower.

Lists of common names of cacti, distribution of the genera, a dictionary of generic and specific names, and a glossary of botanical terms, give the finishing touch to this excellent book. Readers of the book will no doubt look forward with us to the publication of the second book in the series which will deal with the genus Mammillaria.

172 pages, 15 drawings, cloth bound, $2.25 postpaid. Abbey Garden Press (Exclusive representative), 132 W. Union St., Pasadena, Calif.

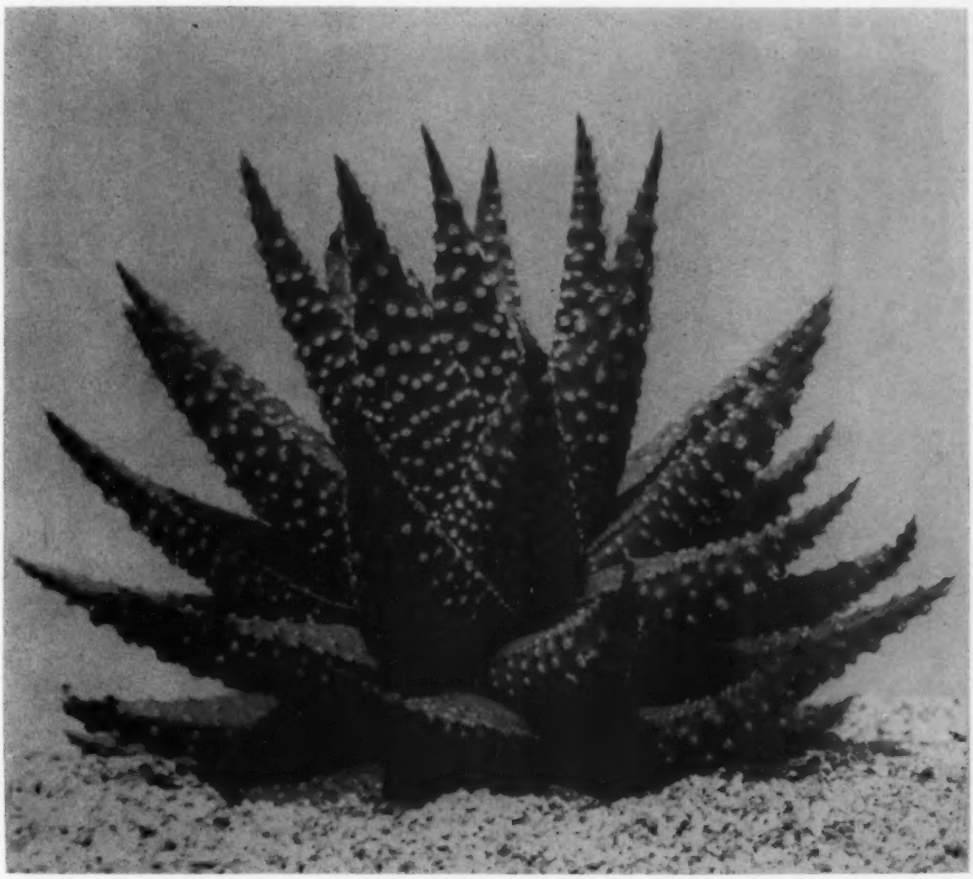

FIG. 12
Haworthia papillosa (Salm) Haw. nat size. A young plant.

Notes on Haworthias

By J. R. BROWN

Haworthia papillosa (Salm) Haw. Suppl. (1819) 58.

Plant forming an elongated rosette of leaves with age, never proliferous, 20-25 cm. tall, to 18 cm. in diameter.

Leaves numerous, crowded, ascending, ovate-lanceolate, acuminate, cuspidate, to 10 cm. long, to 3.5 cm. broad towards base, face somewhat convex, with irregularly scattered tubercles; back very rounded and somewhat obliquely keeled in the upper part, with numerous large and prominent tubercles, never confluent, sometimes more or less transversely arranged.

Peduncle stout, to 4.5 mm. diam., branched, 60-90 cm. tall including racemes, flowers sub-erect; pedicels to 5 mm. long, bracts somewhat shorter, ca. 4 mm., deltoid-acuminate, dull white with a brownish keel; perianth to 15 mm long, obclavate, sub-cylindrical, ca. 4.5 mm. diam. towards base of tube, greenish-white with pale green obscurely striate lines; segments spreading, short, obtuse, channelled, white with green lines, tinged reddish-brown at tips, lower segments more reflexed than the upper and with wavy tips.

Locality; Cape Colony: vicinity of Worcester and Swellendam. In the region of Worcester to Swellendam, doubtfully from the vicinity of Riversdale.

Introduced to cultivation about 1750.

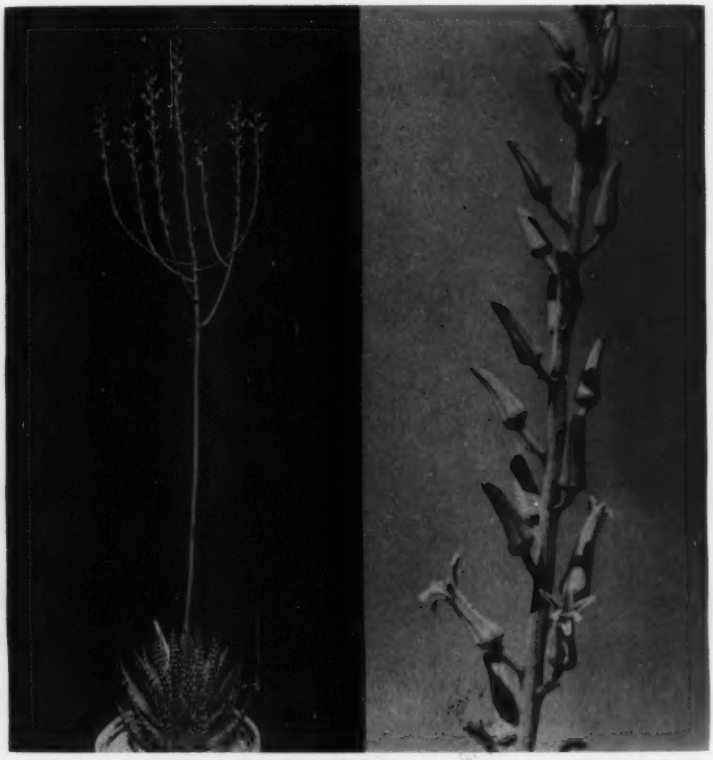

FIG. 13
Haworthia papillosa (Salm) Haw. (Left) In flower, greatly reduced. (Right) Flowers nat. size.

Haworthia papillosa (sect. *Margaritiferae*) is closely allied to *Haw. margaritifera* (L.) Haw. and in the younger stages may sometimes be difficult to differentiate. In leaf color it varies from a lighter more or less glaucous green to dark green, and the tubercles show some variation in size. The glaucous green form with large ivory colored tubercles is a very handsome plant and this form is shown in the photograph of a young plant of *Haw. papillosa,* this particular plant was collected in the vicinity of Swellendam. The tubercles are usually rounder, flatter and with a depressed centre than those of *Haw. margaritifera,* the tubercles of the latter are longer (tending to lengthen downwards) and with a rounded tip.

Haworthia papillosa (Salm) Haw. Suppl. (1819) 58; Revis. (1821) 55; Baker in Journ. Linn. Soc. XVIII (1880) 201, in Th. Dyer, Fl. Caps. VI (1896) 337; Berger in Pflanzenr. IV. 38. (1908) 86; J. R. Brown in Des. Plt. Life VI (1934) 102, fig.; Poelln. in Repert. Sp. Nov. XLIV (1938) 216. *Aloe papillosa* Salm, Pl. succ. Hort. Dyck (1816) 12—nomen, Cat. rais. (1817) 7, Hort. Dyck. (1934) 319, Monogr. (1837) sect. 6 fig. 4; Link, Enum. (1821) 336; Spreng., Syst. II (1825) 69—excl. syn. *Al. erectae*; Roem. & Schult., Syst. veg. VII (1829) 651; *Apicra margaritifera* var. *maxima* Willd. in Berlin. Mag. V (1811) 269.

Haworthia papillosa var. **semipapillosa** Haw. Revis. (1821) 55. This seems to be only a form without tubercles on the leaf faces and no difference in size of plant or leaves has been noticed on the several plants seen. This smoother form seems to occur in the same localities as the more tuberculate form.

Haworthia papillosa var. *semipapillosa* Haw. Revis. (1821) 55; Baker, l.c. l.c., B ger, l.c., 87.—*Aloe papillosa* var. *semipapillosa* Roem. & Schult., l.c.—*Aloe papillosa* var. *minor* Salm, Pl. succ. Hort. Dyck. (1829) 12—nomen, Monogr. sect. 6, sub fig. 4; Kunth, Enum. IV (1843) 501.

FIG. 14. *Haworthia papillosa* var. *semipapillosa* Haw. nat. size. From the vicinity of Bonnievale.

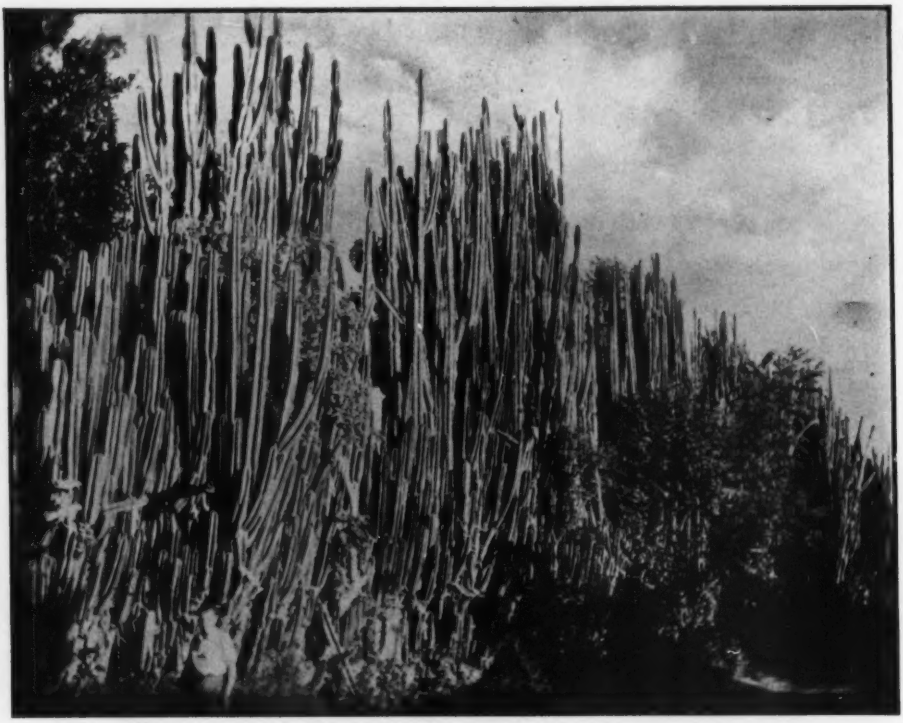

FIG. 15. "*Cereus hexagonus* growing along the highways and coffee plantations in the Department Valle del Cauca, particularly around Palmira, in Colombia. These attractive columns are a beautiful gray and bluish color with very few spines. They are usually six-angled and grow to 30 and 40 feet tall. The natives know them only as 'Tunas' and that they are covered with white flowers in July." Alfred B. Graf, N. J.

QUESTIONS AND ANSWERS

Continued from pg. 14

Question: Which of the following do you consider the best if you could only grow one? *Hylocereus undatus, Eriocereus bonplandii, E. regellii, Selenicereus macdonaldiae?*

MR. L. BONT, Wash.

Answer: My choice would be *Selenicereus pteranthus* as it flowers when smaller if handled right. All of them are good if grown with plenty of sun in summer to keep growth short and stout.

CACTUS AND SUCCULENT SOCIETY OF CALIFORNIA

Meeting of November 13, 1955

The November meeting was held at the W. C. Anderson home at 5161 Trask St., Oakland, California. Myron Kimnach gave an interesting and very informative talk on the winter care of plants stressing, in particular, water, temperature and light.

There was a showing of colored slides which the society has just purchased from Arizona Highways magazine.

Some of the new members just starting their collections brought plants to the meeting for correct naming. Mrs. Thomas brought 2 Astrophytums, *Notocactus attonis, Echinocactus* sp., and a *Conophytum* sp. As usual the small seedlings displayed were virtually impossible to identify. Mr. Lund brought a specimen plant of *Echinocereus englemannii.*

Old-time members also brought interesting plants for discussion. Al Tressler displayed *Cephalocereus* scoparius, *C. apicicephalium, C. oaxacensis (nom. nud.* from Schwarz), *Mammillaria collinsii, M. neopalmeri, M. nejapensis, Thelocactus goldii* and *Cochemia setispina.* Harry Bettencourt brought three plants obtained from the Rio Grande del Norte area in Brazil: *Cephalocereus grounellei, Opuntia weberi* and *Melocactus bahiensis.* Harry Butterfield displayed a collection of Echeverias including *E. semivestita* and *E. subrigida* var. *palmeri.* Al Irving and Myron Kimnach displayed various unusual and rare plants, including *Kalanchoe suarezensis, Adromischus tricolor, A. marianae, Navajoa peelblesiana, Graptopetalum filiferum* and *Orostachys japonicus.*

Thirty-two members were present at the meeting in spite of the very wet and stormy afternoon.

NEXT ISSUE

Dr. M. Cárdenas has thirteen new species from Bolivia. The descriptions and illustrations will start in the Mar.-Apr. issue. The many new cacti still being discovered are a challenge to collectors who are combing the Western Hemisphere ever looking for the last new species. We are all watching T. MacDougall to see what new plants he will bring out of Mexico this season.

SPINE CHATS

LADISLAUS CUTAK

With this issue SPINE CHATS commences its 14th year of almost continuous service. It is true, on few occasions and these can be counted on the fingers of one hand, SPINE CHATS have been omitted, but only because pressure of more important work kept me from mailing this contribution in on time. Whenever SPINE CHATS happened to be omitted, letters usually poured in with the plea to continue the page. As long as I can and as long as the Editor accepts them, SPINE CHATS will appear on the familiar page in the CACTUS JOURNAL regularly.

Since my last chat with you, I can further report progress on my forthcoming book. The galley and page proofs of CACTUS GUIDE have been proofread and corrected during December and an Index prepared, so that only a few minor details remain to be cleared up before actual printing will commence. It is even probable that by the time the next issue of the CACTUS JOURNAL is mailed, CACTUS GUIDE will already be available on the market. Watch the notices of the publisher in various horticultural magazines for the book's debut.

ECONOMIC BOTANY in its October-December 1955 issue contains two very interesting articles which, in portions, deal with succulent plants. The first article, "The Search for Plant Precursors of Cortisone," by four U. S. Government scientists, deals with the search for arthritis-combatting drugs; the other, "Hard Fibers," deals with textile fibers chiefly used for cordage, mats and sacking. Both articles consume 92 pages and are lavishly illustrated with halftones and maps.

One of the four U. S. Government scientists involved in the first article is Dr. H. S. Gentry, who is well known to many of our readers. Some of you will recall him as the author of "Rio Mayo Plants" published in 1942.

Shortly after the end of World War II, a great surge in chemistry of natural products and the development of its applications was undertaken. The Section of Plant Introduction, U. S. Department of Agriculture, concerned itself with the investigation of wild plants as possible sources for vital drugs. One of these projects, the oldest of the programs, was the search for possible sources of the drug cortisone, started in 1950. At the present time cortisone is still manufactured primarily from bile acids of cattle, but intense efforts are being made to find suitable plant sources which would ultimately be cheaper and potentially offer an unlimited source for the raw material. From the first the African Strophanthus vines were the most promising vegetable source but later amaryllidaceous plants received attention and chief among these were the Agaves. About 250 species of the latter have been collected for chemical analysis. The routine collections included 12- to 25-pound samples of leaves, and in some cases root stocks and inflorescences as well. Special repeat collections in lots of 500 to 2,000 pounds were occasionally needed for extraction of an ample quantity of the desired sapogenins. All of the main areas of *Agave* distribution in Mexico and Southwestern United States have been explored thoroughly. In the findings it was shown that the occurrence of sapogenin was not limited to any particular region, although the highest yielders were located in arid Baja California and in the semi-arid highlands of Oaxaca. So it is noteworthy that sapogenins appear to be generally coincidental with climates having marked dry seasons. In the cases of Strophanthus and Dioscorea preliminary cultural investigation was initiated depending upon the results of chemical analysis. In the case of *Agave*, no agronomic studies other than maintenance of a living collection in southern California has been undertaken. It may be worthwhile to mention that Yuccas also received attention in the early stages of this program and these were assembled at the Savannah, Georgia, Plant Introduction Garden. *Yucca gloriosa* and *Y. filamentosa* were the chief species involved.

In the opinion of the four scientists, the fiber interests and research agencies in the United States may be overlooking an excellent opportunity to establish a new fiber industry in our own Southwest. Their recent investigations have uncovered good fiber species, also high in hecogenin content, that would be hardy for certain areas in our Southwestern States. The ideal combination, producing under cultivation a species of *Agave* with superior fiber in which a high hecogenin content would reside in the bagasse or waste material, is certainly not beyond the realm of possibility. An instance is cited where plantations in British East Africa are now producing cortisone from the waste material of *Agave sisalana*, a species with low hecogenin content. An advantage in using *Agaves* for the joint production of fiber and hecogenin in the United States is that marginal and sub-marginal lands could be utilized in areas of low rainfall.

"Hard Fibers" is the term applied most widely to the leaf or structural fibers derived from agaves, Manila hemp, New Zealand flax and various bromeliads and used in the manufacture of cordage and of coarse textiles, as distinguished from the "soft" (bast or stem) fibers derived from flax, jute, etc. The cultivation of hard fiber plants outside of their original habitats has generally been unsuccessful, except in the case of the agaves, particularly sisal, which are now successfully grown in Africa, as well as tropical Asia. Of all the Agaves, sisal has attained the greatest importance as a cultivated plant. Strangely enough, *Agave sisalana*, though indigenous to almost rainless Yucatan and in habitat a typical xerophyte adapted to a dry climate, also grows well in regions with considerable precipitation and even produces a greater amount of fiber.

Extraction of fiber from the leaves of agaves is in one respect simpler than the processing required by the stems of flax, hemp, jute and other plants yielding finer spinning material. Leaf fibers can be cleaned almost completely by machine, whereas even today many stem fibers are still retted previous to being processed. The practice of stripping sisal and henequen leaves by some mechanical device originated in Yucatan, nearly 200 years ago.

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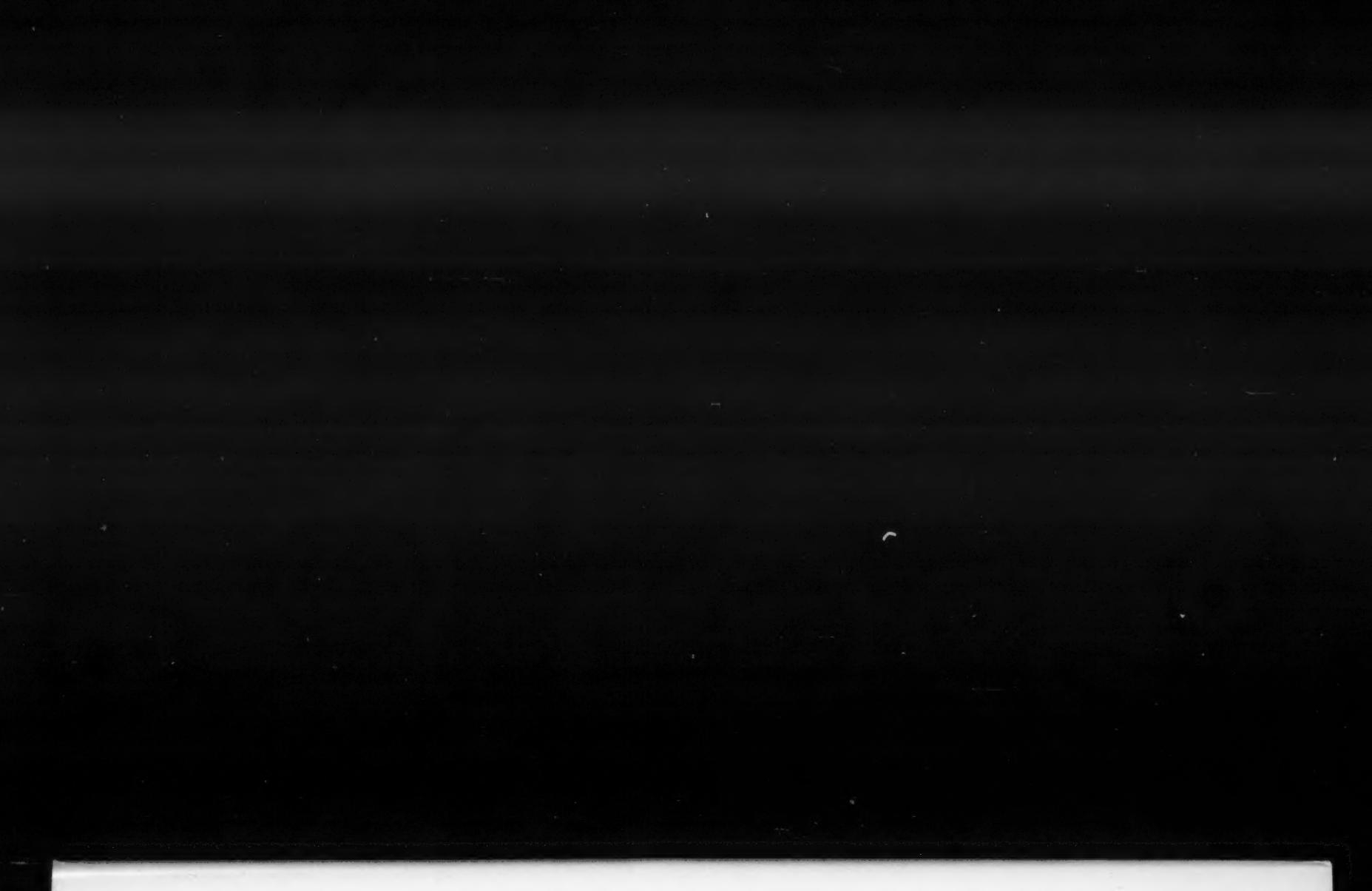
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